THE ORGANIZATIONAL CHALLENGE FOR HEALTH CARE

from

TELEMEDICINE AND e-HEALTH

By

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Abstract:
New technology has been proposed to bring great changes for our societies. In health care telemedicine was met with great enthusiasm and considered an enabler to overcome distance barriers. It is now clear that telemedicine does not spread like fire in dry grass. A more extensive use of telemedicine can imply advantages, and some countries have invested much in technology. The present book shows organizational problems to be crucial for the future of telemedicine, and has two main points: identification of organizational problems and design of solutions to organizational problems. For telemedicine we find many organizational consequences and many types of consequences, but it is not just so that implementing technology has organizational consequences. Organizational changes can be performed first and increased use of telemedicine will follow. Measures of collaboration are important to make telemedicine distance collaboration work, and health care organizations should consider a number of such measures for implementation. Reorganization of where to perform work can result in more telemedicine. A new concept for centralization and decentralization in regions (or large health enterprises) simplifies analysis of where to locate telemedicine. Research on general network organization is well known from the history of organization theory. To work with telemedicine means having a virtual organization. Health care has something to learn from general network research and from research on virtual organizations for other sectors of society than health care. Internal organizational changes are very common when telemedicine is implemented. Forecasting future development for telemedicine is difficult. If health care tackles the situation correctly organizations can be changed to facilitators for telemedicine. Time has come for work with the organizational problems.

Key words: Health care, telemedicine, IT, organization, collaboration, network organization, virtual organization

CONTENTS

Preface

In many countries health care is continuously a part of public debate. We can all become patients and health care issues are relevant for all. The health sector is the sector of society with the highest number of employees. What happens in health care plays a role for the society at large. Today it is obvious that Information and communication technology is changing our society. The process of taking full advantage of ICT in health care is still at an early stage. For telemedicine an enthusiasm was built up in the 1990'ies. After a successful demonstration it is easy to be enthusiastic about the technology! The champions were many, and champions were missionaries giving salvation to infidels. Some seemed to believe in the death of distance.

At the start of the new century it became clearer that telemedicine had diffusion problems and problems with expansion of volume of use. Telemedicine did simply not spread like fire in dry grass. The question then comes up of why so?

The physical infrastructure of modern telecommunications consists of computers connected together. We are dealing with an electronic network. Telemedicine's greatest problem, however, is not to make the technology work. Many can make software and hardware work. Then what about the humanware? It is organizations and humans in organizations who will decide the future of telemedicine. Organizations consist of humans in interaction, and around electronic networks organizations and humans must interact. The question of telemedicine having organizational consequences, or not, is now completely outdated. From empirical research we now know that organizational issues are important for telemedicine.

We have to deal with a number of organizational problems, but there is no deus ex machina (God out of the machine) coming to rescue the organizations. This book identifies a number of organizational problems and solutions to the problems have been designed. It should be noticed that none of these problems seem to be too difficult to tackle. Skilled managers can tackle the problems, but it may be necessary to involve policy-formulating level. If we really mean business about telemedicine's future telemedicine should now enter a new stage. Simple enthusiasm should be replaced with sweat and work. Work with organizations to give telemedicine a real chance. It is not the technology that decides it own future. Still man has got the most extraordinary of all computers. Humans decide the future of telemedicine.

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Chapter 1: The organizational challenge for health care – from telemedicine and e-health

Organizational problems will
be crucial for the future
of telemedicine.

Introduction

In a historical perspective technology has played a fundamental role for society and organizations. The industrial revolution changed society, organizations and work significantly. The new IT and telecommunications have been proposed to bring even greater changes and a new society called the information society. The information society is now gradually replacing the industrial society in many countries in the world (Castell 2000). The changes are many and many sectors are changed. Some sectors have already seen great organizational changes, for example the bank sector. Other sectors are in an early stage of the changes the future may bring. An example of this is the health sector.

Health technology assessment

Health care has a considerable history of technology implementation. The importance of technology for health care, life and health of patients is fundamental. In the history of health care ICT (information and communication technology) represent a new development. When technology is so critical technology assessment becomes important. Health technology assessment (HTA) has been called one of the major research enterprises of our time (May et al. 2003).

For ICT the health sector is still at an early stage of development.

Health technology assessment is important and includes organizational assessment.

The objective with health technology assessment is to give the best possible basis for health care decision makers at all levels (for example managers, politicians, clinicians).

The history of HTA starts in the early 1970ies. In the last decades international literature on assessment of medical technologies has been growing significantly and in the 1990ies many EU countries developed public institutions for HTA (Banta 2003). The centers are connected together in a network called The International Network of Agencies for Health Technology Assessment. Health technology assessment is a multidisciplinary specialty. Which intervention to use is an important question. It includes what works well, how well, at what cost, for whom, in what circumstances, and with what impact (Gabay & Walley 2006).

Health technology is commonly given a broad definition (Banta 2003; Jørgensen & Danneskiold-Samsøe 1986; Lyngstadaas; Myhre 2000). The following is an example: application of equipment, drugs, medical and surgical procedures in health care, and the

following supporting and organizational systems (Jørgensen & Danneskiold-Samsøe 1986).

HTA can obviously include organizational evaluation. The present book has focus on organizational issues. A more encompassing evaluation of medical technologies can go through several stages and include economic evaluation, factors related to the patient (for example medical and patient satisfaction), and the technology itself (Jørgensen & Danneskiold-Samsøe 1986; Kristensen et al. 2001; Rigby 2006; Rigby et al. 2001). When a broad HTA has been performed the collected information must be put together. A synthesis can show consequences of technology use, when and how and where the technology should be applied, recommendation of the technology or no recommendation of its use. Assessment results are presented in a form suited for target group(s). The target group can be decision makers and other interested parties.

What is telemedicine and e-health?
Telemedicine is an enabler to transcend distance barriers for collaboration. The term telemedicine has been given a number of definitions (Aas 2003b; Abro 2001; Jennett et al. 2005; Myhre 2000; Nymo 1993; Pedersen & Hartviksen 1994; Strömgren 2003;), like 'medicine at a distance', 'the use of telecommunication technology to assist in the delivery of health care', and 'examination, monitoring, treatment and management of patients and education of patients and personnel by systems giving immediate access to expertise and patient-information, independent of where patient or relevant information is located geographically'. Early in our century it became clear that many found the term telemedicine difficult. The difference between telemedicine and IT became less clear and the collective term e-health was made. E-health encompasses all applications of ICT in health care (telemedicine, electronic patient records, health information on the Internet, e-referrals, medical decision support systems, computerized hospital stay information for statistical purposes etc). The new term was rapidly taken into use in the international professional community, an example is the US based scientific journal *Telemedicine Journal* which changed name to *Telemedicine Journal and e-Health*.

It can sometimes be difficult to decide what is telemedicine and what is not. A new term e-health has been made. E-health encompasses all applications of ICT in health care. In the present book the term telemedicine is used much because the book is about 'the use of telecommunication technology to assist in the delivery of health care'

Telemedicine has a longer history (Strömgren 2003), but played for long a pretty modest role. Around 1990 it was clear that telecommunications, computers and IT in general had developed much. The speed of transmission of larger amounts of information had increased and the usability of ICT for health care became larger. A new era for telemedicine started. The interest for telemedicine grew substantially in the 1990ies. The number of possible applications of the new technology developed much and continues to develop. Telemedicine is now an enabler to transcend both distance and time barriers for collaboration. We speak about synchronous collaboration (same time presence by collaboration parties, for example the remote consultations done by video-conferencing equipment) and asynchronous collaboration (technology which does not require same time

presence, examples are teleradiology and store-and-forward teledermatology) (Stronge et al. 2005).

Telemedicine technology has a number of applications, like teleradiology, remote consultations, telehomecare (virtual visits to the home and monitoring in the home), telepsychiatry, teledermatology, teleotolaryngology, telepathology, teledialysis, store-and-forward telemedicine, diabetes, wound care, cardiology, postoperative care, ophthalmology, geriatrics, endoscopic gastroenterology, acute medicine, rehabilitation, electronic messages (for example discharge abstracts to primary care), military applications, telemedicine to ships and oil rigs at sea (Aas & Geitung 1998; 1999)

Problems for telemedicine

During the 1990ies the enthusiasm for the new technology increased. Champions for telemedicine were missionaries and the sceptics few. An international telemedicine community formed, a number of international conferences took place, and new scientific journals were founded. The belief developed that telehealthcare might revolutionise the practise of medicine (Finch et al. 2003).

Today we clearly see a contrast between the enthusiastic support for telemedicine, the many projects performed, the resources going to telemedicine and the lack of a wide diffusion and high volume of use.

The situation for telemedicine is not problem-free. A British group of researchers wrote: "Telemedicine has largely failed to systematically penetrate the 'marketplace' for civil health care provision in the United Kingdom and United States" (May et al. 2003).

The situation in the UK and the US is not unique. Telemedicine has not been spreading like fire in dry grass. Telemedicine is mainly characterized by trial, demonstration, or experimental services which are not continued after the project period is over (May et al. 2003). Telehealthcare "typically fail to become part of routine health care delivery" (Finch et al. 2003). It does not easily normalize, i.e. become embedded in every day practise (May et al. 2003).

The champions seemed to believe that if the technology is implemented a large volume of use will automatically follow. But to believe that e-health distance collaboration will work if just the technology works is to have seen only the tip of the iceberg. The expectation of an immediate diffusion of telemedicine was unrealistic. The situation has some similarity to the burst of the dotcom bubble at the start of the new century. This was followed by pessimism about the future of virtual organizations. The problems for telemedicine have resulted in some pessimism internationally. It is well known from diffusion studies that diffusion of technology does not always follow a pattern based on simple causes (Rogers 2003). For the telephone to reach 10 million people 40 years passed (Detmer 2000).

In the early stages of the new telemedicine development it is understandable that much focus was on making the hardware and software work. Without a well functioning technology the rest is impossible. Even the telemedicine research literature seems to have a pro-telemedicine bias (Strömgren 2003). Studying implementation projects easily results in a positive bias. A knowledge building on the experience of enthusiasts can result in a grave underestimation of problems. The evidence base for telehealthcare is not as strong as some of its champions have suggested (Finch et al. 2003).

Advantages

Implementation of ICT is not indifferent for patients. New technology may well play a role for improved quality. ICT has been proposed to have a potential to larger impact on human health than sanitation, antibiotics, vaccines, and other major medical advances (Detmer 2003). There is no doubt that with the technology patient access to care can be improved. Patients can be diagnosed earlier, clinicians can obtain support in their decisions (e.g. second opinion), health care organizations can earlier receive interpretations of radiology images and results from laboratory tests, chronic diseases can be monitored in the patients home, and health data from different levels of care can be pooled into individual episodes of care for the study of which organization of care results in best outcome. When ICT supported cooperative work is established the networks may functions as a channel for spread of new ways of diagnosing and treating. With the new telecommunications infrastructure production can be reorganized to obtain productivity improvement (for example reorganization of radiology in regions). Then costs per unit produced can be lowered.

If the situation for telemedicine does not improve important advantages will be lost.

Organization

For the relationship between organizational structure and technology research has been done since the 1960s (Roberts & Grabowski 1996). It is now well established that when technology is implemented organizational effects may be seen, and this also goes for IT (Robey 1987; Kaplan 1997; 2001; Orlikowski 1992; 2000; Lorenzi 1999; Lorenzi et al. 1997; Kraemer & Danziger 1990; DeLone & McLean 1992; Morton 1991). Organizational and social issues are critical in the implementation of information systems (Kuhn & Giuse 2000). It is not just making the technology itself work that matters. It should be noticed that organizational consequences of technology do not consist of a simple cause and effect relationship. Effects of technology in organizations may be viewed as a result of the technology itself, characteristics of the organization, situational elements, and an interaction between such factors (Gladwin & Wilson 2000; Kaplan 1997; Orlikowski 1992; Markus & Robey 1988).

Organizational problems have been proposed to represent the most significant obstacles for telemedicine (Magrabi et al. 2005; Whitten & Kuwahara 2004). Telemedicine is a technology of the most intrusive sort (Bangert & Doktor 2000; Rigby 1999).

Identifying telemedicine's organizational problems, and designing solutions to these problems, can well be of help for the future telemedicine development.

Neither God nor ghosts come out of computers. Organizations and people in the organizations will play a decisive role. A telemedicine implementation can have the objective of telemedicine to become a stable routine activity. If the implementation only considers the technology it can easily fail. In the long run telemedicine work will have to be done without the presence of clear champions.

In the later years empirical research has been performed on organizational problems connected to telemedicine. The difference between early writing desk speculations and what empirical research has told about organization and telemedicine is substantial. Empirical research has an important role to play in the study of organizational effects. The research clearly shows that working with the new technology is not organizationally neutral.

For telemedicine we find many organizational consequences and many types of consequences. But it is not just so that implementing technology results in organizational consequences. Organizational changes can be performed first and increased use of telemedicine follows.

For future volume of telemedicine the importance of organization will be large (Aas 2000; 2001a; b; c; 2002a; b; 2003a;b; 2005a;b; 2006a;b; Jennett 2003; Lam & MacKenzie 2005). Organization should be adapted to technology. In a country like Norway investment in ICT for health care has reached a level where infrequent use makes the network a doubtful investment. And Norway is not alone. The low utilization of telemedicine is a serious problem. The advantages are not obtained.

We are dealing with a grave underestimation of the organizational problems.

All understand that work with the organization must be done to make an ordinary organization work. We do not have a well functioning ordinary organization just if equipment is moved into an empty building and people are moved into the same building. And nothing else. But it is equally wrong to believe that telemedicine will have a great future without doing an organizational job. Telemedicine means having a virtual organization (see chapter 5). The virtual organization is an organization found behind clicks on computers and not behind bricks. This does not make it less relevant to perform work with the telemedicine virtual organization than with ordinary organizations. Organizations must be willing to do the organizational job. Managers can no more just sit

and watch. They must sweat and lead organizational changes. Replacing simplified optimism with realism can be very important for the future of telemedicine.

The book
In the telemedicine community few have a background in organization and management. In spite of organizational problems with telemedicine being significant knowledge about the issue seems modest.

> The objective with a book is to transfer knowledge, present an overview of knowledge about the issue, increase the understanding for the issue, and show how the problems can be solved.

It is not just so that an organizational problem is a problem, but an organizational problem can be a problem for which a solution exists. Little knowledge to play with can be a problem for organizational evaluations. The many organizational issues are distributed on the chapters and results from empirical research constitute an important part of the book.

The target group for the book can be all actors of the ICT community, managers of health care at all levels, health care personnel, politicians and students.

Chapter 1
The organizational challenge for health care
Gives an introduction to the issue treated in the book. Organizational problems are pointed out as important for telemedicine.

Chapter 2
Making collaboration work
Measures of collaboration are important to make distance collaboration through technology work. Measures of collaboration are identified in this chapter. It is not a matter of course that telemedicine collaboration works well. A well functioning technology is not enough to obtain collaboration.

Chapter 3
Networked regional organization,
or the networked health enterprise
Telecommunications can become an infrastructure around which health services are organized. This can mean new organization of services in geographic areas. Centralization and decentralization are important terms. A new concept for centralization and decentralization in regions /or large enterprises simplifies analysis of where to locate work. Changed organizations can result in more telemedicine.

Chapter 4
The network organization
Network organization is nothing new and something connected to new technology only. Research on network organization, in general, is well known from the history of organization theory. Telework means the formation of human networks around the

telecommunication infrastructure. Health care has something to learn from general network research.

Chapter 5

The Virtual Organization

When telemedicine work is done we have a virtual organization. Research has been done on virtual organizations in other sectors than health care. Health care has something to learn from this research, for example concerning management.

Chapter 6

New technology and internal organizational changes

Internal organizational consequences of telemedicine are very common. For different applications of the technology we find similarities and differences in internal organizational consequences. When telemedicine is implemented changes should be made in the organizations.

Concluding remarks

The future of telemedicine depends on how organizational issues are tackled by the health care organizations. This makes the future of telemedicine difficult to predict.

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Chapter 2: Making collaboration work

Measures of collaboration are important to make distance collaboration through technology work.

Introduction

Health care is fundamentally a collaborative process. Persons working alone do not have all the skills and all the knowledge necessary to solve the diagnostic and treatment problems. We find collaboration across professions, specialities, hospitals, hospital departments, and levels of care. With collaboration value is added, and clinical result is improved for many groups of patients.

In international literature we find several definitions of collaboration (Cohen & Mankin 1999; Biggs 1997; Paul 2005; Dhar & Olson 1989). One definition is (Chen et al. 2002):

> Collaboration – definition:
>
> Making joint cognitive effort toward achieving an agreed upon goal.

The goal may well be making a correct diagnosis. The term cooperation is related to collaboration, but the two terms do not mean exactly the same (Cohen & Mankin 1999; Hatchuel 1997; van Gils 1984; Webster's New World Dictionary 1994). In definitions of cooperation mutual interests can be stressed more than what is done in collaboration definitions (Axelsson & Axelsson 2006; Hatchuel 1997).

In collaboration employees' knowledge plays a fundamental role. The value of collaboration is a function of the quality, relevance, and complementarity of the employees' knowledge (Paul 2005). Employees in health care have different competence profiles and they must interact to maximize the result. This means communication. Communication is a part of collaborating. The definitions of communication are generally broader than collaboration and cooperation definitions (Ash 1997; Dhar & Olson 1989; McCarthy & Monk 1994; Touissaint et al 2003). One definition is (Cohen & Mankin 1999):

> Communication – definition:
> Communication is the exchange or transmission of information.
>
> Notice: Communication skill and communication errors are important for health care quality.

Communication has been considered the central aspect of all organizing and work has been done to produce a general theory of communication (Czarniawska 1997). In Jurgen Habermas' work a distinction is made between communication where the purpose is to have certain effects and communication oriented towards understanding (Bulik et al. 2005). Clinical work in telemedicine is mainly oriented towards the effect of obtaining right diagnosis and treatment. It should be noticed that good communication is not just dependent on personality, but can be learned (Kurtz et al 1998).

Communication occurs in different settings. One of them is face-to-face interaction. Some call face-to-face discussion the gold standard of communication (Hinds & Kiesler 2002). Research on face-to-face communication, compared to other types of communication, has a longer history (McCarthy & Monk 1994). Face-to-face contacts may have a strong impact on bonds and social contracts (Hinds & Kiesler 2002). The nature of the task seems to play an important role. Tasks, which are personally sensitive or implies conflict, are sensitive to type of communication, other more problem solving tasks less so. The involved tend to protect the primary task at a cost to own subjective effort (McCarthy & Monk 1994). Diagnosing and giving treatment has a problem solving aspect.

Communication is important for health care quality. In fact communication skill can make a difference for factors like patient satisfaction, symptom resolution, and physiological outcome (Kurtz et al 1998). Communication errors in health care can have a strong impact on patient morbidity and mortality (Touissaint et al 2003). Attention should be given to communication processes and possibilities for designing them in different ways. Establishing a common ground is important for effective communication (McCarthy & Monk 1994). Establishing a common ground means sharing perceptions of what should be done, and what has been done during communication. Collaboration is not just a professional process, but also a social process. Trust is a major factor in inter-organizational work (Black et al. 2002). People have, in general, a tendency to trust or distrust (Brown et al 2002). When persons do not trust each other collaboration becomes difficult.

The new technology represents a new possibility for collaboration. Computers and electronic networks can be connected into networks for communication between people. Telemedicine organizations, often found at great distance of each other, work together to solve work tasks. Telemedicine requires collaboration between participating parties. It is not a matter of course that such collaboration works well. Collaboration, in general, does not necessarily work well (Buunk et a 1998; Chanlat 1997), and collaboration across organizational borders is a source of significant problems (Wagner 2000). Telemedical work often occurs across organizational borders. A well functioning collaboration can promote a higher volume of telemedicine, and with an increasing volume of telemedicine the importance of good collaboration is greater. Knowledge about collaboration can be obtained by research. Such knowledge may bring improvements in collaboration. Broadly it can be said that co-operation is dependent on personal and situational factors (Bunk et al 1998; Chanlat 1997). Communicating has a social dimension, and when communication occurs by ICT development of relations may become more difficult. It becomes important to understand the character of behaviours that facilitate effective telemedicine interaction. Communicating by ICT can be seen as a challenge. Different ways of working can be important for trust, communication quality, productivity, and quality.

Telemedical co-operation is definable as teamwork (Shulman 1996; Hertog & Tolner 1997; Ovretveit 1997). A team consists of several people (a group) organized around a set of objectives (Hertog & Tolner 1997). A well accepted definition of a team is (Hertog & Tolner 1997):

Team – definition:
A set of interpersonal relationships structured to achieve established goals.

Notice: Delivery of health care by teams is positive for quality.

When co-located team members share understanding of goals and tasks they can manage with little explicit communication. When workload and time pressures are high, reducing work related communication has the potential to save costs (Mackenzie et al. 2005). It should be noticed that when health care is delivered by teams this can be positive for quality (Wagner 2000). When personnel from different organizations communicate telemedically they form virtual teams or virtual organizations (Cascio 1999) (see chapter 5 for more about the virtual organization).

Diffusion of telemedicine can be promoted by transfer of knowledge and interest in a collaboration situation. When telemedicine is implemented the telemedicine collaboration itself can result in changes in collaboration patterns and other changes in collaborating organizations. Skill development and learning can result from capability transfer across organizations. Collaboration can develop new skills and human resources faster and cheaper than developing them in-house (Schilling 2005). Telemedicine can be an important source of learning (Aas 2005a). This should not be overlooked, or just considered an accidental side product. The new technology represents a possibility for complementation of single organizations capabilities. Here capability complementation means pooling of capabilities and resources of organizations collaborating by telecommunications (Schilling 2005). The collective capabilities of collaboration organizations are then enhanced.

One side of the collaboration issue is possible change in social capital. For work done by organizations different forms of capital are necessary, i.e. social, intellectual, physical, and financial capital. Social capital is about relations. An organization cannot manage without relations to other organizations and persons belonging to other organizations. Social capital can be defined as the social networks of mutual trust and the associated norms of reciprocity, or simply the value norms generated within an interactive social networking system (Hjelm et al. 2003; Welsh & Pringle 2001). It should be noticed that communities and societies with high levels of social capital have been proposed to work more productively and cooperatively than those with low levels (Anderson & Boubullian 1997; Welsh & Pringle 2001). Work with telemedicine may well enhance social and intellectual capital of organizations.

When telemedical work is performed individuals participating in the network co-operate towards a common goal (for example to make a correct diagnosis).

Shared visions and a sense of common purpose are important for network organizations (Chisholm 1998; Weinstein et al. 1997). But organizations collaborating by

telecommunications can have both compatible objectives (for example in the telemedicine work) and incompatible objectives (for example they can compete about economic resources). Health care organizations must then balance the partly compatible objectives against the partly incompatible objectives (van Gils 1984). Goal formulation can be made concrete, and focus for example on: the time it takes before the radiology interpretation is mailed back to the requesting organization, and matching of work force qualifications with type of work to obtain best possible quality.

Organizations can view starting collaboration as not risk-free. Lack of trust can lead an organization to believe that a partner will exploit the relationship. An example can be fear of loss of work tasks to collaborating organization. Organizations may choose not to cooperate because they wish to be in complete control. Trusting behaviour can increase vulnerability to the collaborating party (Black et al. 2002). Likewise assessing skills and knowledge well at a distance can be difficult.

Until recent years we have had little information about what organizations should do to obtain well functioning telemedicine collaboration. It is especially about searching for effective means of coordinating across both distance and time. It is necessary to identify which specific measures organizations should take to make collaboration by telecommunications work.

Necessary to: identify collaboration problems for work with telecommunications in health care and find measures to make such collaboration work.

TWO CASES OF TELEMEDICINE ORGANIZATIONAL COLLABORATION

Performing work by telecommunications is a deep change in production process. Several aspects of work can change, like who performs the work, where work is performed, change in type and number and timing of elements of the production process, and type of knowledge needed to perform work. In telemedicine a distinction is made between synchronous and asynchronous work. Synchronous telemedicine requires the presence of all participants at the same time, but with asynchronous telemedicine participants do not need to be present at the same time.

The two cases presented here represent asynchronous and synchronous collaboration, i.e. teleradiology and telemedicine remote consultation.

It is important to study the collaboration function for both synchronous and asynchronous telemedicine. Problems with collaboration can be different. Measures for improving collaboration then become equally different. Especially when work groups are distributed collaboration can be challenging (Bajwa et al 2002). For telework, however, we do not

necessarily find only problems with collaboration. The opposite is that ICT leads to improved communication and collaboration (Meijden et al 2003).

For collaboration, without telecommunications, research has been done to obtain information about how to obtain a well functioning collaboration (Cohen and Mankin 1999). For example, behaviour such as harmonizing and compromising, encouraging, standard setting, shared goals, participation and listening, free expression of ideas, flexibility, agreement on what important words mean, sharing of information, how members coordinate their efforts, recognition of relevance of each others expertise and ability to rapidly learn cooperating parties language, are important for a good collaboration (Cohen and Mankin 1999). For telemedicine we need to search for specific measures of collaboration.

The case of teleradiology collaboration

The German professor of physics, Wilhelm Konrad Roentgen, discovered in 1895 an unknown type of rays. He called the rays x-rays. Roentgen soon understood the importance of his discovery. The importance of x-rays for medical diagnostics was quickly recognized and Roentgen was awarded the first Nobel Prize in physics in 1901. Radiology builds on information found in images. Today the images are increasingly produced by digitalized equipment giving digitalized images. With PACS (Picture Archiving and Communication System) all is digitalized, and film and development of film are unnecessary. The images are stored in computers and shown on screens for interpretation. PACS makes RIS (radiology information system) necessary. RIS makes it possible to identify images, to obtain the right interpretation or request, information about transfer of the patient, and images transmitted for second opinion.

Radiology has its own type of telemedicine called teleradiology. Teleradiology may be defined as "the practise of radiology at a distance using telecommunications" (Akselsen et al. 1993). The first teleradiology trials were performed at the end of the 1950ies in Canada, and in the USA there were several in the 1960-1980ies (Ruggiero 1998). In the early 1990ies we find a renewed international interest for teleradiology. At this time film based images were scanned, and transmitted by telecommunications to other locations.

PACS has made sending radiology images from one health institution to another far easier and faster than before. A new era for radiology has begun.

The production process in radiology has two fundamental elements: capturing images and interpretation of images. Traditionally both are done in the same radiology department. It is now relevant to consider reorganizing the production process. Images can be captured in one organization and interpreted in another.

The radiology sector is now in a process of great change in many countries. PACS is replacing older equipment and we find great capacity telecommunications. Technically sending radiology images from one health institution to another is far easier and faster than before. A new era for radiology has started. The production process in radiology has two fundamental elements: capturing (taking) images and interpretation of images. Traditionally capturing images and interpretation is done in the same location (often a

radiology department). The new technology makes it relevant to think in terms of reorganizing the production process. Images can be captured in one organization and interpreted in another. This is a fundamental reorganization of the production process.

Teleradiology requires collaboration between organizations and persons.

Significant problems with collaboration will be negative for the future of teleradiology.

It becomes important to search for measures which can improve teleradiology collaboration.

Transmitting radiology images from one location to another requires collaboration between persons and organizations. Limited research has been performed on teleradiology and co-operation (Aas 2005b). To integrate teleradiology into routine activity has been considered both as difficult, and more successful, than other applications of telemedicine (May et al 2003; Salvador et al 2002). Significant problems with collaboration will be negative for the future of teleradiology. In future knowledge about the collaboration will be important, and improvements in the collaboration may itself increase the volume of teleradiology. We need to identify collaboration problems with teleradiology and find measures which make such collaboration work. The following is based upon an empirical material obtained by qualitative interviews of resource persons with much experience with PACS and teleradiology (Aas 2005b).

Measures for improved collaboration in teleradiology (see Table 2.1 for an overview).

1) Make someone responsible and distribute tasks
Radiology departments should make someone responsible for the teleradiology co-operation. Without this, teleradiology can be considered as something which «disturbs other activity», «looked upon as something creating trouble». At a department which had tried, without someone given the responsibility, a participant said «People had to be torn out of their daily duties and the images were more of a disturbance».

To make someone responsible for the teleradiology becomes important. Not at least when teleradiology of a greater volume is planned. At each location daily responsibility should be given to someone for sending, receiving, and seeing to that received images are interpreted. This includes taking care of the technology, that personnel from different locations can co-operate, and that routines for the co-operation are known. It is necessary to have 'contact-persons' responsible for the contact with co-operating departments. The contact-persons should have an understanding of teleradiology, including technology and referrals, and know the contact persons of co-operating departments. The contact-person and the responsible for teleradiology can be the same person. If distant partners continuously change, problems of communication can be the result (Uldal & Størmer 1998). Also transmitting e-referrals seem to require a responsible person on the receiving side (Wotton et al. 2003). When roles are defined clearly ambiguity about who should decide what is avoided (Cascio 1999). Only the most essential matters are left for the

management to decide. Those who have responsibility can also perform telemedicine work themselves. Co-operation is easier with them (Aas 2001a).

Not at least when a greater volume is planned someone should be made responsible for teleradiology.

It is necessary to have 'contact-persons' responsible for the contact with co-operating departments. The contact-person and the responsible for teleradiology can be the same person.

Radiology departments involved in teleradiology should communicate about distribution of tasks. A partner of communication said, «We must do so. If not the co-operation becomes somewhat chaotic». And the result should be: «All involved should have the same opinion about distribution of responsibility and distribution of tasks». «Good logistics may result in increased teleradiology».

To avoid chaotic conditions radiology departments involved in teleradiology should communicate about distribution of tasks.

Common meetings can create a common understanding of each other's tasks. All personnel involved should participate in the meetings.

When steps of a production process are distributed on different locations, a common understanding of each other's tasks can be created by having meetings together. All involved should participate in the meetings (Karasti et al 1998). The organizations are responsible for arranging such meetings. The departments should go through the steps of the production process together, and decide who should perform which tasks, and who should be responsible. This applies not only to the normal situation, but also when problems occur. Feedback plays a role for teleradiology co-operation. Participants can discuss their work at regular intervals. They may discuss the production itself and maintenance issues.

2) Knowing each other

For partners of teleradiology co-operation knowing one another is considered important. One said: «First of all one has to know each other», and another: «Functions well with hospital (name of hospital) because we have a good communication. We know each other». Contact can be maintained by arranging meetings at certain intervals, for example once per year. Afterwards the participants can "chat friendly on the phone".

In teleradiology individuals from different organizations co-operate. Knowing one another plays a positive role for the co-operation. Also in other telemedicine knowledge of each other plays a positive role for the co-operation (Aas 2001). When persons lack knowledge of each other, and feel insecure about the technology, the result can be little teleradiology. Face to face meetings are essential to foster mutual trust and promote communication

(Weinstein et al 1997). Fear of communication with others can predict the will to communicate (Eikebrokk 1997).

Table 2.1. Overview of 17 measures for improved teleradiology collaboration.

1) Make someone responsible and distribute tasks	To make someone responsible for teleradiology is important. Particularly when teleradiology of a greater volume is planned.
2) Knowing each other	Teleradiology means co-operation between individuals from different organizations. Knowing one another plays a positive role for the co-operation. Face-to-face meetings should be organized.
3) Problems of attitude	Co-operation problems are not just software and hardware problems, but also 'humanware' problems. Personality plays a role. Better co-operation when the involved are motivated and interested. Use persons with positive attitudes or motivate personnel for teleradiology.
4) Support from management	Support and involvement from management necessary for teleradiology. Departments with an active and interested leader are more positively evaluated by co-operating departments. Higher management levels should develop departmental managers into champions for teleradiology.
5) Organizational merger	Teleradiology in-between organizationally merged departments works better. Evaluate merger as a tool for problem reduction.
6) Organize time for teleradiology at the radiology departments	Teleradiology can compete with ordinary work tasks for the personnel's time. Pressure to participate in ordinary work can be great. Managers must inform all personnel that teleradiology is an equally legitimate work task. Organize the departments' resources both for ordinary work and teleradiology.
7) Distribution of production capacity in-between radiology departments	Teleradiology of a larger volume may lead to significant change in the distribution of workload between co-operating departments. Regional health authorities may have to reconsider distribution of production capacity in-between radiology departments.
8) Experience with teleradiology	Experience plays a positive role. Better co-operation with larger volumes teleradiology. Health authorities can promote larger volumes by deciding criteria for teleradiology, which results in and maintains larger volumes.
9) Good referrals (requests) and good interpretations	Good referrals especially important for teleradiology. They make it easier for the radiologist to get a good idea about patient problems. Competence in referrals can be developed and electronic referrals with standardized contents can be used. Good quality interpretations play a positive role for the co-operation. Interpretations can be written on an electronic form with standardised contents.
10) Quick replies to clinicians	Easier to co-operate when requesting clinician receives the interpretation quickly. Routines should be established securing that clinicians receive interpretations quickly.
11) Improved schooling of radiographers	Competence is necessary when problems with the technology, for assistance with daily use, and teaching of new personnel. Radiographers can be educated into «superusers» taking care of such tasks.

12) Thorough learning of procedures	The involved should be familiar with procedures used. Personnel can be «drilled» in procedures for sending and receiving images.
13) Standardisation of procedures and nomenclature	When radiologists perform interpretations it is important to know how the images were obtained. Radiology departments can communicate and agree to use the same radiology procedures. One and the same procedure must have the same name at co-operating departments. Departments can use standardised nomenclature developed at national level, or communicate to obtain standardised nomenclature.
14) Economic and ethical motivations for teleradiology	Economic incentives can be used to promote teleradiology. Costs should be covered for participating organizations. Teleradiology can improve quality, and it becomes ethically indefensible not to use it. When departments discuss teleradiology co-operation the ethical motivation should be a part of the discussion.
15) Connect all the departments' workstations	It should be possible to transmit images to and from all workstations. All radiology work stations should be integrated in the departments', the hospitals' and the health region's network
16) Knowledge of technology and IT-personnel	Teleradiology co-operation works better when partners have access to good technology knowledge. Hospital IT-personnel should learn about the new technology, have an introduction to how a radiology department works, its needs, relationship to the rest of the hospital, and other parts of the health service. Larger radiology departments can consider employment of IT-personnel at own department.
17) Technology and co-operation	Technical problems with communication make teleradiology co-operation difficult. Co-operating departments can have the same technology (hardware and software), require from vendors that technology they buy can communicate, and a region can have a common computer store.

When persons lack knowledge of each other, and feel insecure about the technology, the result may be little teleradiology. Face-to-face meetings can foster mutual trust and promote communication. When teleradiology is planned, face- to-face meetings should be arranged. Periodic face-to-face contact can then be necessary to develop and reinforce relationships.

When persons meet face to face they can discuss issues of common interest. They can develop a shared understanding of the cooperative work process and agree on common procedures (Karasti et al. 1998). All having a task in the cooperative work should participate, irrespective of position (Karasti et al. 1998). Proximity and face-to-face interaction can be critical for establishing collaborative interpersonal relationships early in working partners' interactions (Walther et al. 2005).

Some may think that communication through technology change the interaction between health personnel and patient, and decrease quality of care. Face-to-face contact is considered better. Research from other sectors than health care has shown that physical proximity can have positive effects and that proximity has been shown to be hard to simulate in for example videoconferencing (Hinds & Kiesler 2002).
Periodic face-to-face contact can be necessary to develop and reinforce relationships (Barrett et al. 2004). An empirical study from home health care showed that a mixture of actual and virtual visits does not compromise quality (Demiris et al 2003).

With teleradiology new social networks are formed and the social capital of organizations becomes higher (Welsh & Pringle 2001). Sharing of perceptions and creating a common ground is important for effective communication (McCarthy & Monk 1994; Mynatt et al 1997). When relationships are built between organizations they can jointly develop new knowledge (Hagedorn & Duysters 2002).

3) Problems of attitude
Problems of attitude is a real problem in telework. In an empirical study of teleradiology one respondent said: «At the human level it is about motivation and individuals. Generally there is a positive will to do this thoroughly», and another respondent: «Much is found at the human level», and another said: «At hospital (name of hospital) they are positive to giving service. They reply quickly and we have the same enthusiasm». But negative experiences with co-operation also exist: «More difficult to co-operate with (name of hospital). People there are less interested», and another said: «--- co-operation is more difficult towards (name of hospital). It is a lack of interest and contradictious attitudes --- In my mind this is lack of will to co-operate».

The co-operation problem is not just a software and hardware problem, but also a 'humanware' problem. Emotional conflicts can arise when different personalities cooperate. In telemedicine such conflicts can become inter-organizational and make collaboration difficult.

Problems of attitude is a real problem in telework. Emotional conflict can arise when different personalities cooperate.

It is a leader's task to discuss problems of attitude with the personnel (and to change attitudes).

Conflicts in organized work can consist of three main elements: Conflicts of interest, conflicts in values, and psychological conflicts (Chanlat 1997). Barriers for co-operation may consist of a wish to protect own territory and authority (Berggren 1989; McCaughan 1998). Culture can be important, and culture refers to the patterns of values and beliefs that people learn in their respective social environments (Chanlat 1997). Conflicts can exist at different levels: Interpersonal, inter-group and inter-organizational. The co-operation works more easily when the involved are motivated and interested. It may be wise to use persons with a positive attitude, or to motivate the personnel for teleradiology. From other types of telemedicine we know that personality plays a role for co-operation (Aas 2001a).

4) Support from management

Support from management seems to be important for teleradiology. Departments with an active and interested leader are more positively evaluated by co-operating departments and do more to make teleradiology work.

Final responsibility for external activity rests with department leaders. When organizations work externally support and involvement from the management is necessary. Teleradiology should not only be implemented by initiative from champions of the technology. Virtual co-operation creates new roles for managers. They need to involve themselves in issues of external co-operation. Managers must establish contact with departments they want to co-operate with, find solutions to problems in the teleradiology co-operation, and make their support to teleradiology visible for own employees.

The staff involved in teleradiology should receive support from management. An active and interested manager promotes teleradiology.

Managers should establish contact with departments they want to co-operate with and find common solutions to problems.

For managers telemedicine means that less of their organizations work is performed with direct control through own chain of command. When power is reduced this may have consequences for manager status, and be viewed as threatening. Failure to collaborate may result if organizations are clearly hierarchical (Mohrman 1999). In virtual work responsibility can be pushed down in the organization as low as possible (Aas 1997), and the autonomy at operative levels should be large enough to realise own potential (Hertog & Tolner 1997).

5) Organizational merger

Organizational merger can have positive effect on teleradiology. Respondents from some radiology departments have strikingly little to tell about co-operation problems. These respondents performed teleradiology in-between organizationally merged departments. One of them said: "Very simple to co-operate" and another "It is perfect". They also specifically mentioned the positive effect of merging organizations. Their comments were clearly different from that of respondents, which have teleradiology co-operation with organizationally separate departments.

As organizational merger has a positive effect on teleradiology co-operation, merger can be used to reduce problems with the co-operation. Merger of departments can be done as a part of a merger of hospitals, or radiology departments are merged without merging the hospitals. Merging departments of radiology is not necessarily motivated by teleradiology only, but also by a wish for improved coordination in general. Intra-organizational teleradiology between remote units of the same hospital has also been called a 'regional PACS' (Caramella et al 2002).

Merging of hospitals can be done by merging a few or all in a larger area. It is hardly enough to merge hospitals and let the radiology departments take care of the co-operation. A situation will then be established with common top management for the hospitals, but with separate chains of command down to the radiology departments. The radiology departments should be merged themselves with a common management.

Organizational merger can be used to reduce problems with the co-operation. Organizational merger has positive effect on teleradiology co-operation.

Radiology departments can be merged without merging hospitals. This has not been much tested out, but is technically possible. In hospitals radiology department are often co-located with clinical departments, and consequences for this cooperation should be analysed. An internal market can be organized with purchasers and providers. Costs must be calculated for the services a radiology department receives from the hospital (for example housing and heating), and services delivered to the hospital (for example radiology services to the bed-departments). The hospital can pay radiology departments based on fee-for-service or a total annual budget based on knowledge of historical costs. We know little about economies of scale for radiology departments. Merging of many radiology departments can result in an organization difficult to coordinate and manage. Merged departments can form an independent organization, or be managed directly by a regional level (in public health care organizations).

For electronic communication the organization's CEO has been shown to have a positive and substantial influence (Schmitz & Fulk 1991). The common leader at merged departments can promote common solutions to problems, and the feeling of belonging to

one and the same department by arranging common professional and social meetings. Merged organizations will have a common budget and no discussion about distribution of costs and incomes between sites limits teleradiology. Total production capacity can be exploited without organizational barriers. Personnel can rotate between locations, and when they learn to know conditions at other locations this may make co-operation easier. Problems with vacancies and sick leaves can be solved more easily by rotation.

Co-operation has been proposed to be easier to establish at operational than at strategic levels (van Gils 1984). Common goal formulation can be viewed as a tool for problem solving. Formulating goals has been considered important for organizations. For private industry MBO (Management By Objectives) has roots back to the 1950ies (Mintzberg 1994; Lægreid 1991). When IT is implemented, and for virtual teams, formulating goals can be important (Mohrman 1999; Eason 2001). Communication on goals for teleradiology, however, seems to be of limited value, and work with common goals cannot replace an organizational merger (Aas 2003a).

6) Organize time for teleradiology at the radiology departments
Radiology departments' work must be organized to allow time for teleradiology. Without, personnel can say they «do not have time» for teleradiology. Teleradiology must be included among the daily work tasks.

At radiology departments employees will often have to share their time between teleradiology and ordinary activity. When workload with ordinary tasks is great the pressure to participate in this can be significant. The manager must inform all personnel that teleradiology is an equally legitimate work task.

For larger departments, with much teleradiology, a separate organizational section for teleradiology can be considered.

Radiology departments traditionally work by serving clinical departments and teleradiology means tackling a new partner of co-operation. Teleradiology is intrusive in an organization's activity and can disrupt its autonomy. The volume of teleradiology can be too small to be the only work task of an employee. Employees must then share their time between teleradiology and ordinary activity. Teleradiology can in general compete with ordinary work tasks for the personnel's time. When the workload with ordinary tasks is great the pressure to participate in this can be significant. Responsibility for organization of work rests with the department manager. The manager must inform all personnel that teleradiology is an equally legitimate work task. If not teleradiology workers risk being rejected by the surrounding organization as an 'alien body' (Hertog & Tolner 1997). For larger departments with much use of teleradiology a separate organizational section for teleradiology can be considered. If workload varies over time, and the personnel cannot shift section they work for, the result can be periodically poor adaptation between work capacity and workload for the teleradiology section and the other section(s).

7) Distribution of production capacity in-between radiology departments
A radiology department receiving large amounts of images for interpretation «must have the capacity to serve» others.

Teleradiology of a larger volume may lead to significant change in the distribution of workload between co-operating departments. The question of adapting distribution of production capacity comes up. Health authorities, or high-level management in large enterprises, may have to decide a new distribution of production capacity in-between radiology departments. This may also involve specialization in types of radiology taken care of by different departments. Problems of this kind are given a further treatment in chapter 3 of this book.

8) Experience with teleradiology

Experience plays a positive role for teleradiology. Teleradiology can be «easier with those who have been a part of the system for a longer period». Less experienced departments may quickly reach the same level when experienced departments «teach the other hospitals». The most positive attitudes are found at departments «where they have experienced the value of teleradiology when something acute happens».

Experience plays a positive role for telemedicine. Co-operation works better when the volume of teleradiology is large. Criteria should be decided for teleradiology which results in, and maintains, a larger volume.

The co-operation works better when the volume of teleradiology is larger. Experience is also known to be a positive factor for other telemedicine (Aas 2001a). A larger volume results in more experienced partners of co-operation. Increased volume has also been found to give better radiologist ratings of teleradiology (Krupinski et al 2003). High-level management can promote a larger volume by deciding criteria for teleradiology, which results in, and maintains, a larger volume. Likewise departments experienced with the technology can play a teaching role. Persons from such departments can visit inexperienced departments, inexperienced departments can have someone they can consult at experienced departments, and common meetings can be arranged where experienced departments play a major role.

9) Good referrals and good interpretations

For teleradiology good referrals are especially important. The involved say: «More easy to co-operate with (name of hospital) --- information is more easily available and better information. It is about better referrals, interpretations». The co-operation becomes easier when referrals are done by «filling in a form which can be mailed easily».

Good requests make it easier for the radiologist to get a good idea about patient problem and previous treatment. In teleradiology patient and responsible clinician are not easily available. Hospitals departments should develop their competence in referrals, and put work in obtaining good referrals. Accurate information in the written request is important (Caramella et al 2000). The answer can be electronic referrals with standardised contents, but such electronic referrals may require: *«--- much work to fill in. It could have been more simple» (Aas 2005b).*

Good requests especially important for teleradiology.

Good interpretations play a positive role for teleradiology co-operation.

Standardised electronic referrals may require demographic and clinical information, practical information like procedures for transfer of information and images (e.g. who is responsible for the transfer, who is to receive the radiologist's interpretation), when and how reply is wanted (e.g. immediately, by telephone, fax, e-mail), type of radiology examination wanted, radiologist wanted to perform the interpretation, if a third hospital is involved and who there, and if radiology examination of the same problem has been performed previously with which interpretation. Standardised forms can also be made for specific groups of patients, for example when a local hospital wants interpretation by a neuroradiologist.

10) Quick replies to clinicians
It is easier to co-operate when requesting clinician «gets the interpretation quickly».

When interpretations are received by the clinician later for teleradiology, than for other radiology, a negative image of teleradiology can be created. Continuity of care may be suffering (Haggerty et al 2003). Routines must be established securing that clinicians receive the interpretations quickly. Quick replies from the radiologist are evaluated positively.

Routines must be established securing that clinicians receive interpretations quickly. When interpretations are received by the clinician later for teleradiology, than for other radiology, a negative image of teleradiology can be created.

For acute cases the obligation for quick action is clear.

For acute cases the obligation for quick action is clear. For non-acute cases quick replies can be promoted in several ways. Organizational measures at radiology departments allowing time for teleradiology are important. Economic incentives where organizations obtain incomes by fee-for-service are important (Aas 1995). The technology gives a possibility, which can be exploited: Images from different locations can be stored in a common computer. The radiologists can automatically be informed on their screens that images are waiting for interpretation. Clinicians can be informed on their screen when an interpretation has arrived.

11) Improved schooling of radiographers
All departments need a «group of people with better knowledge of the technology. It is too much to learn for all». Some departments have given especial education in the technology to radiographers and call them «super-users».

All departments should have people with better competence in technology. Radiographers can be educated into ‘super-users’.

When everything works, the use of PACS and teleradiology is not especially demanding, but when problems occur more competence is necessary. All departments should have people who can teach newly employed how to use the technology, help others with daily use, search for errors, and correct less complicated errors. Radiographers can be educated into ‘super-users’. For more difficult problems several hospitals can share a helpdesk, the hospitals IT personnel should have a good knowledge of the technology, and technology vendor’s expertise should be available.

12) Thorough learning of procedures

Work processes must be well learned. Personnel can be «drilled» in the procedures for sending and receiving images. Participants can have: «seen the value of well functioning procedures when something acute happens».

With thorough learning of all elements of the work process insecurity on how to perform teleradiology disappears. The procedures themselves must be well worked through to ensure they are rational.

With thorough learning of the work process insecurity on how to perform teleradiology disappears. The involved can be «drilled» in the procedures. It is especially important that routines are well known in acute cases.

In acute situations time does not allow discussion on how to perform teleradiology. It is especially important that routines are well known and learned in acute cases. If the co-operation does not work in the acute situation teleradiology can be discredited, but when it works personnel can see the value of teleradiology, and a positive atmosphere for extended use is created.

13) Standardisation of procedures and nomenclature

It is important to have similar radiology procedures at co-operating sites. The involved in teleradiology report: «We must have similar procedures. When we interpret images from other sites we must know how the radiology images were obtained», and «We have similar procedures. It has come with time». When teleradiology is performed internationally «more focus must be given to international standards».

Radiology procedures. For the interpretation it is important to know how the images were obtained. A solution can be that radiology departments use the same radiology procedures. Merger of departments make standardisation of procedures easier. The department leader can see to that procedures are standardised for the merged departments. Low stability in the work force may make it difficult to follow established procedures. Standardised procedures also make it easier for departments to rotate personnel between departments. The technology makes it possible to send images internationally for interpretation

(Robinson et al 2003). Attention must then be paid to international standards for radiology procedures. Great similarity in the practise of medicine is considered good quality. Teleradiology may result in harmonisation of professional standards.

For the interpretation it is important to know how the images were obtained. Radiology departments involved in teleradiology should use the same radiology procedures.

Teleradiology co-operation makes standardised nomenclature important.

Nomenclature. Teleradiology makes standardised nomenclature important. *«It is necessary to agree what things should be called, this means having the same nomenclature». One and the same radiology procedure must have the same name».*
In Norway work has been done to obtain a common nomenclature for radiology procedures. If teleradiology is done internationally international standardisation of nomenclature is necessary. Also for standardisation of clinical vocabularies progress could have been greater (Detmer 2003).

Departmental routines. Work procedures, in general, can be standardized. Communication on common routines for departments becomes important with a larger volume of teleradiology. Talks on routines can be important for how fast replies arrive.
The common routines can be made in writing. All steps of the work process can be communicated about (from the patient's arrival, to sending of images, to receiving images at the cooperating radiology department, and the clinician receiving the radiologist's reply). The routines can include how sending and receiving should be organized. A hospital receiving images for interpretation from many hospitals can see chaos without standardised routines. When one hospital wants another to interpret images the rule may be that the first hospital does all preparatory work. For example the sending hospital can inform which images of an MR (magnetic resonance) examination they want the hospital to scrutinize. Then the receiving hospital does not need to search through several hundred images (or more). Especially university hospitals can receive greater volumes of images.

14) Economic and ethical motivations for teleradiology
Economic incentives can stimulate work to be done. A partner in teleradiology said: «Economic incentives are important for teleradiology. Communicating must have a net value», and another: «Money, that means using financing methods to create an incentive. Today we loose on teleradiology. If we look at the workforce resources it is an activity with loss».

According to economic theory economic incentives influence actions (Aas 1995). Economic incentives can be used to promote teleradiology and type of radiology images transmitted. If costs are not covered teleradiology means economic loss. Especially with large volumes of teleradiology this is important. In the four types of economic analysis of health economics (cost-minimization, cost-effectiveness, cost-utility and cost-benefit analysis) both utility and costs are taken into consideration. The cost-effectiveness of for example getting more second opinions has not been subjected to much analysis. The new technology can result in having more second opinion. Large-scale implementation of PACS gives possibility to benefit from reorganizations (e.g. by limiting 24-hours duties on

fewer hospitals). This new possibility has also not been much subjected to economic analysis.

Economic incentives can be used to promote teleradiology.

Teleradiology can improve quality in such a way that it becomes ethically indefensible not to use it.

In health work ethics is fundamental. Respondents mentioned ethical motivation, one said: «Our motivation is that we look upon this as so quality promoting that it would be ethically indefensible to do else», and another: «That people (at the radiology departments) --- see the value of it and not only think of themselves».

For departments of radiology to transmit images they must see the use of teleradiology. Teleradiology can improve quality in such a way that it becomes ethically indefensible not to use it. With PACS images can instantly be made accessible for all connected. For example radiologists and clinicians in different locations can look at the same image and communicate by telephone. A transfer of competence can occur resulting in improved quality. Ethical motivation should be a part of the teleradiology discussion. From other areas we know that members of a group can experience high motivation when some conditions are met, for example a group task is a whole and meaningful piece of work, outcomes of the group work make a difference for other people, and the task requires different skills for successful completion (Cohen & Mankin 1999).

15) Connect all the department's workstations

All radiology work stations should be integrated in a department's, the hospital's, and the health region's network: *«Work stations receiving images must be integrated in the department's network --- It cannot be so that a tele-studio at the other end of the building is used».*

When teleradiology can be performed only from one workstation we have a barrier for teleradiology. It should be possible to transmit images to and from all workstations at a department.

A situation should be established so all images can be transmitted to and from all workstations. Especially when the volume is large and workload must be distributed between several radiologists. Also for other types of telemedicine easily available equipment is known to be of importance for volume (Aas 2002).

16) Knowledge of technology and IT-personnel

Implementation of PACS, and teleradiology based on PACS, means a need for IT-competence in the running of radiology departments. Participants in teleradiology report: *«Technical knowledge plays a role for how easy the co-operation works», and «At (name of hospital) they have too little knowledge to tackle problems which come up. This is about technology», and: «Many of our problems are about IT. We do not get the necessary follow*

up --- from the IT department --- They lack understanding of what we do and what it is good for. If they go home without having finished (i.e. a repair job) they are of the opinion that it is not their responsibility».

The co-operation works better when co-operating partners have good knowledge of the technology. Many hospitals have IT-departments. If radiology departments use the hospitals common IT-department the IT-personnel may lack understanding of the radiology department's needs. They should have an introduction to how a radiology department works, its needs, relationship to the rest of the hospital, and other parts of the health service. Work instructions can be changed to include support to the radiology department. One question is whether the radiology departments should employ their own IT-personnel. Especially larger radiology departments could consider employment of IT-personnel at their department. The magnitude of needed assistance can be part of the consideration.

17) Technology and co-operation
A number of companies produce Picture Archiving and Communication Systems. It is not a matter of course that different PACS systems can communicate. When co-operating departments have the same technology co-operation works better. A partner in teleradiology gave the following solution: *«Must be that fewer PACS systems were implemented»,* and another: *«Vendors should make PACS solutions which can communicate".* Compliance with DICOM standard (Levine et al 1998) is not necessarily enough. Also, PACS does also not work without a RIS: *«The RIS systems must also be able to communicate because this is the retrieval system for patient information».* It should be noticed that different image compression systems can make it impossible for the receiver to see images.

Transmitting larger volumes of radiology images requires electronic networks with great capacity. Then they: *«Must build a great capacity network».* Too low capacity results in waiting for the arrival of images. When several hospitals have one computer, as a common image store, images, and the other patient information, become equally accessible for all connected.

The case of collaboration in telemedicine remote consultations

In health care the right competence is not always present at the site of consultation. The problem can be solved with referral to specialist care, but travelling to specialist care can take a long time and be expensive. Patients can loose work hours, and waiting lists can be long. It is often primary care doctors who consult medical specialists at hospitals, but remote consultations also have other applications. For example a specialist at a hospital can consult a sub-specialist for advice about a difficult case. A psychiatric nurse, working with a patient who has been transferred to own local community, can have regular consultations with the psychiatrist, responsible for the patient before discharge from mental hospital.

Joint consultations between specialists and general practitioners, outside of telemedicine, are known to lead to educational gains, improved patient welfare, and more efficient use of the health service (Harrison et al 1996). Telemedicine remote consultations can mean cooperation between levels of care, inter-professional, and inter-specialty work. The involved may get new knowledge and add knowledge to their group's collective knowledge. They may learn professional knowledge, about different work processes, values and behavior within other disciplines, develop new contacts and networks, modify

own practice and generate new ideas. A broader understanding consisting of several perspectives is built up. For example primary health care's combination of knowledge about local health cares, and broader knowledge of the patients' social situation, with specialist competence - can make a difference in clinical work.

Telemedicine remote consultations mean cooperation and sharing of knowledge. A broader understanding consisting of several perspectives can be built up.

With remote consultations travels to specialists can become fewer, but remote consultations can also be seen in the perspective of a need for improved communication.

The measures for improved collaboration in remote consultations, proposed in this chapter, were developed on the basis of an empirical study (Aas 2001). Focus was on four areas: telepsychiatry, teledermatology, telepathology frozen-section service, and teleotolaryngology. In these types of telemedical work the consulted specialist plays an important role, but the personnel on the other side of the network are also active. They communicate with the specialist early in the remote consultation and define what the problem is. In teledermatology and tele-otolaryngology they operate the camera, or the endoscope with camera connected, and the specialist instructs them to focus on specific locations. At the conclusion of the consultation they communicate concerning diagnosis and treatment. The general practitioner can then be instructed to write prescriptions.

In telepsychiatry much communication can take place. For example the personnel consulting the psychiatrist can give information on patient behaviour and problems, and can also focus the camera on the person speaking. The psychiatrist instructs the personnel concerning further treatment. It should be noticed that psychiatric patients can feel more open and comfortable communicating via telemedicine (Whitten & Kuwahara 2004), and even prefer telepsychiatry to face-to-face consultations (Detmer 2000).

In the frozen section pathology service information about the patient can be faxed the pathologist on beforehand. After having ensured they are speaking about the same patient they communicate about the information. The surgeon then shows the tissue lump to the pathologist and they decide how it should be sectioned. After sectioning and dyeing the laboratory technicians can communicate with the pathologist, concerning operation of the microscope, and obtain feedback on the technical quality of the section. At the end of the session the pathologist tells the diagnosis to the surgeon. The surgeon then repeats it to be sure that there are no misunderstandings.

In the present chapter measures for improved collaboration are presented merged for four specialties. A totally separate presentation for the four specialties was evaluated, but little could be gained by this. Characteristics of co-operation in remote consultations are not necessarily that dependent on specialty (Aas 2001a).

Measures for improved collaboration in telemedicine remote consultations (see Table 2.2 for an overview).

1) Experience with remote consultations
Experience plays a positive role. The co-operation becomes better when participants are experienced.

Telemedicine remote consultations should preferably not be performed just now and then, but management can promote larger volumes of remote consultations. Involvement in sessions should not just rotate between larger numbers of people. Use of the same set of persons means increased experience. Experienced persons can be more relaxed in front of a camera and also this makes it easier to cooperate.

Management can promote larger volumes of remote consultations. The co-operation becomes better when participants are experienced. It is also wrong to believe that involvement in telemedicine is just for the young professional.

Experience from work within own discipline has a role to play. In teleotolaryngology it can be easier to co-operate with experienced otolaryngologists, and in frozen section telepathology it can be easier to co-operate with experienced surgeons (Aas 2001a). It is wrong to believe that involvement in telemedicine is just for the young. Involvement in remote consultations means working in the 'presence' of others. When well-learned tasks are performed in the presence of others alertness and motivation can increase. When work is done with difficult tasks the presence of others can be distracting and reduce accuracy (Hinds & Kiesler 2002). The young and inexperienced can view their job as more difficult.

Table 2.2. Overview of 10 measures for improved collaboration in telemedicine remote consultations (see text for further information).

1) Experience with remote consultations	Better co-operation with participants who are experienced. Management can promote larger volumes of remote consultations, use the same set of persons for telemedicine, and use participants with several years of working experience from their discipline. It is also easier to co-operate with persons who are relaxed in front of a camera
2) Meeting at the same time	Telemedicine remote consultations is synchronous work. Employees of different organizations may have highly different schedules and find it difficult to involve on short notice in a simultaneous co-operation. The solution can be long term planning by making half-year schedules for when sessions with remote consultations should take place.
3) Knowing each other	Knowing one another can play a positive role for the co-operation. Face-to-face meetings between participants can be organized. Having met each other personally is not decisive, but the co-operation can become easier.
4) Different personalities	Personality plays a role for the co-operation. Important that participants are reliable, effective, and interested. Use persons with positive attitudes or motivate personnel for remote consultations.
5) Chairman for sessions with several participants	When several speak at the same time what is heard on the other side of the network becomes quite messy. A chairman should be appointed for such sessions. Those who want to speak can be added to a list of speakers, when it is a person's turn the microphone can be passed over, and the camera can be focused on the one speaking.
6) Good preparations	Preparations play a positive role. Easier to co-operate with those who are well prepared and well structured. When necessary participants should prepare for sessions.
7) Make participants responsible and distribute tasks	Easier to co-operate with those who are responsible formally and in reality. With many involved in a session important to decide who should do what. Tasks should be distributed with a following responsibility.
8) Education and level of education	Participants should be educated for the telemedicine work, for example laboratory technicians should be educated for their work with telepathology frozen sections. Level of general education plays a role, for example psychiatrists can prefer patients to be followed to the studio by a general practitioner rather than a nurse.
9) Better co-operation with those who need help	Easier to co-operate with persons who need help. Need for help can be a criteria for connecting personnel to a network.
10) Interest for technology becomes a distraction	Occupation with technology during a session can disturb. Participants should be advised to focus on the patient/ subject during sessions, and not with the technology.

2) Meeting at the same time

In telemedicine remote consultations co-operation often occurs between persons from different organizations. It is synchronous work and this means that participants must be present in the studios at the same time. It is not a matter of course that employees from different organizations, on short notice, can involve themselves in a simultaneous co-operation. They can have highly different schedules. Deciding appointment time for each single remote consultation is not especially productive. Finding appointment times for a higher number of consultations then means that much total time is spent. The problem has a solution.

Long term planning can be done for when sessions with remote consultations should take place. This means making half-year schedules for when sessions with remote consultations will take place. A session can be, for example three hours after lunch on Mondays.

The involved personnel (for example primary care physician and medical specialist) can make half-year schedules by speaking together on the phone, while both have their personal appointment books on their desk, and both have booking possibility for their respective studios available on their PCs (with indication of when the studio is free). With half-year schedules meeting at the same time becomes a far smaller problem. Also finding appointment times for the patients becomes easier and they can receive treatment earlier.

The technology makes it easier to arrange meetings for multi-professional groups. This is relevant in psychiatry. As the participants do not need to travel for the meetings less time is consumed. The meetings can take place earlier and the patients may enjoy a treatment plan with broader professional input at an earlier stage.

The teleopathology frozen section service is also a multi-professional cooperation. Making tissue sections and consulting the pathologist take some time. A surgeon involved in a telepathology frozen section service said: “Many are waiting for me in the operating theatre. This sometimes makes me shrink from doing it”.

3) Knowing each other

Knowing each other can play a positive role for the co-operation. Participants in remote consultations may report: “easier to co-operate with those that I have met personally”.

Organizations starting with telemedicine remote consultations should arrange face-to-face meetings between the participants.

Having met each other personally is not decisive, but the co-operation becomes easier (Aas 2001a). Remote consultations mean collaborative work and problem solving by communication. Communication skills are important for collaboration (Cohen & Mankin 1999). In communication a common ground should be established and maintained. For this face-to-face meetings have a role to play. Communication is not effective unless all

participants share a similar perception of what has been discussed and agreed upon (McCarthy & Monk 1994).

4) Different personalities

Personality plays a role for the co-operation. It is important that participants are reliable, effective, and interested. Management can use persons with positive attitudes or motivate personnel for remote consultations. Telemedicine suits poorly for a random substitute, for example in the general practitioner role.

Co-operation can in general be dependent on situational factors and persons (Buunk et al 1998; Chanlat 1997). Participants in telemedicine can have different personalities. It is no doubt that differences in personality are noticed during remote consultations. More in psychiatry than in other specialties, but this may be related to longer sessions and the contents of the co-operation being more complex. People with different personalities tend to dislike each other. The degree to which one party likes another party is called affect (Brown et al 2002). A person with negative affective tone is hostile, irritable, upset, nervous, and afraid. A person with a positive affective tone is determined, proud, strong, interested, active, and inspired (Brown et al 2002). Absenteeism from collaboration may be linked to a negative affective tone (Brown et al 2002), but in remote consultations absenteeism is not common. It is not easy for those who have agreed to participate to be absent, and participants can have chosen each other for the collaboration. In computer mediated communication people like better those who contribute more to the groups' endeavour. While in face-to-face groups liking is more based on non-task factors (Walther et al. 2005). In remote consultations all have to do their task.

Differences in personality are noticed during remote consultations.

Management should motivate personnel before starting with remote consultations or simply use persons with positive attitudes.

In addition to the professional side telemedicine is a social process where trust plays a role. Good leadership can play a role for development of trust. Trust can develop over time in virtual work (with more experience with each other).

The general impression is that the co-operation in remote consultations works well.
The explanation can be that procedures and roles are quite similar to those found in ordinary consultations.

Telemedicine collaboration is not just a professional process, but also a social process. In social processes trust plays a role. For collaborative virtual relationships trust is an important factor (Brown et al 2002) and lack of trust is a potential difficulty in virtual interaction (Barrett et al. 2004). In the virtual teams literature trust has received particular attention (Walther et al. 2005). Trust develops over time in virtual work, but it may be more difficult to maintain in virtual groups (Walther et al. 2005). Trust is dependent on personal relationships, past experiences, shared norms of obligation and responsibility (Walther et al. 2005). Virtual teams can be self-managed, but management of virtual teams can receive more attention. Good leadership can play a role for development of trust.

Trust and personality traits can also be linked to each other. Mistrust can have its origin in different personalities. It may be that the mere following of any rules reduces uncertainty and leads to trust and liking in virtual groups (Walther et al. 2005). Perhaps rules are advantageous to group work in general and not only to virtual groups (Walther et al. 2005). The 'rule' for how to perform a remote consultation is found in the ordinary consultation. It should be noticed that trust and liking are associated with productivity (Walther et al. 2005).

5) Chairman for sessions with several participants
When co-operation occurs by telecommunications it becomes especially visible if all speak at the same time. What is heard on the other side of the electronic network becomes quite messy.

Not at least for sessions with many participants a chairman should be appointed. The chairman of telemedicine sessions can intervene. Those who want to speak can be added to a list of speakers, when it is a person's turn the microphone can be passed over, and the camera can be focused on the one speaking. It becomes very visible if one person talks all the time. The technology itself has the potential to improve collaboration.

6) Good preparations
It is easier to collaborate with those who are well prepared and well structured.

Preparations play a positive role. When participants prepare for telemedicine sessions this plays a positive role for the collaboration. Participants should prepare for sessions, when necessary.

7) Make participants responsible and distribute tasks
It seems to be "easier to co-operate with those who are responsible formally and in reality".

Tasks and responsibility should be distributed. With many involved in a session it is important to decide who should do what. Higher-level management should make someone responsible for the remote consultations. The participants themselves can be made responsible.

8) Education and level of education
It is a necessity for remote consultations that participants are educated in the different parts of the production process. For example laboratory technicians must be educated for their work with telepathology frozen sections.

Participants should be educated for the telemedicine work. This includes learning how to use the technology. Level of general education also plays a role, for example psychiatrists can prefer patients to be followed to the studio by a general practitioner, rather than a nurse.

9) Better co-operation with those who need help
It is easier to co-operate with persons who need help.

When considerations are made for connecting people, need for help can be a criterion for inclusion in the network. Persons who need help are more motivated.

10) Interest for technology becomes a distraction

Interest for the technology is not just positive. Occupation with technology during a session can disturb.

Participants should be advised to focus on the patient/ the issue during sessions, and not on the technology.

GENERAL TRAITS OF TELEMEDICINE COLLABORATION

The general impression is that telemedicine collaboration can be made to work well. This applies to both teleradiology and remote consultations. Communication technology does not represent an insurmountable barrier for good co-operation. It has been proposed that for work groups to work well, it is important they have the same norms and the same idea concerning objective (Shulman 1996). The objective to make a correct diagnosis and deliver good treatment should be the same for all involved in telemedicine. Fundamental understanding of the work process is the same for participants on both sides of the network. Good results may be related to such factors.

It should be noticed that availability of the technology does not automatically result in collaboration. Establishing a situation with good collaboration is dependent on several factors. In the present chapter two cases of telemedicine collaboration are used. They represent synchronous (the remote consultation) and asynchronous (teleradiology) telemedicine services. Asynchronous and synchronous work are two clearly different ways of working. We also have other examples of asynchronous (e.g. store-and-forward teledermatology) and synchronous (e.g. teledialysis) work in telemedicine. Due to lack of data concerning collaboration measures other cases are not used.

Teleradiology and remote consultations are pretty different forms of telemedicine, but we find obvious similarities (and differences) in measures to improve collaboration. When work is done by telecommunications this can create some similarity in collaboration measures needed for different types of telework. The differences in collaboration measures can be due to differences in the nature of the services (radiology and clinical medical consultation are different work processes) and their synchronous and asynchronous nature. For teleradiology 17 measures for improved collaboration are listed (Table 2.1), and for telemedicine remote consultations 10 measures (Table 2.2).

Three measures for improved collaboration are the same both in teleradiology and remote consultations: make someone responsible and distribute tasks, organize face-to- face meetings (knowing each other plays a positive role), telemedicine should be organized so participants get more experience with telemedicine (the collaboration works better when the volume is larger).

In telemedicine it is important to define roles clearly. Who should do what, and who is responsible for what, should be made clear. In teleradiology this can be so important that without "--- the co-operation becomes somewhat chaotic". This is about coordination. Coordination is done when separate work groups take the activities of other groups into account. Good coordination is necessary for work to be done without delay, for all elements of the work process to be performed, and to avoid duplication of work. For traditional collaboration coordination occurs within location, but across locations for telemedicine. Problems with coordination can be critical, especially in situations and for patients with a great need for coordination. This can be in the acute situation and for patients with a complex need for care. In the acute situation medical consequences of poor coordination can be severe. For patients with a complex need individual care plans can be made. Individual plans can be made in electronic form available from different locations, and show the roles different organizations (and people) have to cover the needs. It is thinkable that the value of a network increases as the number of participants increase. But if coordination costs increase, with an increasing number of participants, this must be taken into consideration.

The opinion that face-to-face discussion is the universal gold standard of communication is not supported by all (Olson et al. 2002). Telemedicine can function well. Telemedicine seems to require that participants have met and that they meet now and then. Lack of face-to-face interaction may make it more difficult to determine shared meaning and understanding, agree upon common procedures, develop an agreed to framework for the work, and to work out conflicts (Karasti et al. 1998; Mohrman 1999). Periodic face-to-face contact can be necessary to reinforce relationships between participants (Barrett et al. 2004). The frequency of the telemedicine communication is in itself a factor. Much telemedicine work gives much experience and telemedicine becomes routine. Routine frequent communication contributes to good coordination (Staples & Cameron 2005). It seems reasonable to believe that much use of telemedicine makes organizations more similar in work processes. They must learn from each other how to collaborate effectively or continue to struggle with lack of coordination.

Four collaboration measures in teleradiology have some similarity to two collaboration measures in telemedicine remote consultation (the measure called problems of attitude in teleradiology has some similarity to the measure called different personalities in remote consultations, the teleradiology measures improved schooling of radiographers, thorough learning of procedures, and knowledge of technology and IT-personnel have some similarity to the remote consultation measure education and level of education). The teleradiology measure 'connect all the department's workstations' has some similarity to what has been found previously (Aas 2002) for remote consultations (easily available equipment plays a role for the volume of remote consultations). In sum eight of 17

teleradiology measures are similar, or have some similarity, to remote consultation measures. Six of 10 remote consultation measures are similar, or have some similarity, to the teleradiology measures.

Close to half of the collaboration measures for both teleradiology and remote consultations are either similar or have some similarity.

A study of general electronic meetings showed that it may be more difficult to come to an agreement in electronic meetings than in face-to-face meetings, and the decisions may become more unconventional (Kiesler & Sproull 1992). Data from telemedicine work do not confirm such findings. It has been proposed that work groups may see a crisis in their history, which changes the way in which work is done (Morton 1991; Shulman 1996). The studies, which the present chapter is based on, give no indication of more dramatic episodes in the telemedicine collaboration, but obviously experience has been accumulated and practise changed accordingly. In cooperation personnel with higher status can dominate (Chanlat 1997; Wagner 2002). It is little reason to believe that differences in status play a major negative role for telemedical co-operation. Telemedicine can make differences in status less visible. It is thinkable that when different professions collaborate, differences in professional languages, values, and objectives represent a problem. But this does not seem to point itself out as a particular problem in telemedicine work.

It seems reasonable to conclude that research on collaboration is important for the future of telemedicine. There are some collaboration measures which are different for teleradiology and telemedicine remote consultation. This may point in the direction of a need to study collaboration for other applications of the technology. Different applications of the technology may require somewhat different collaboration measures. A knowledge pool should be developed with information about which collaboration measures different applications require. Several collaboration problems exist, but none of the problems seem large enough to prevent effective co-operation. Implementation of measures for improved collaboration may prevent problems with collaboration from stopping telemedicine work.

WHAT ORGANIZATIONS CAN DO

Little telemedicine means a mismatch between activity made possible by the technology and actual activity. The present chapter shows that organizations planning larger volumes of telemedicine have a job to do. Health care organizations must put in place measures for improved collaboration. The telemedicine potential can only be fully realised if the right measures are taken. If organizations starting with telemedicine struggle to make it work the answer can be to take advantage of the experiences of others. The present chapter makes it possible not needing to start from scratch.

Inter-organizational collaboration requires involvement of management. In telemedicine, management at different levels should be involved, including top management. Cooperation has been proposed to be easier to obtain at operational level. Cooperation at strategic level is more problematic (van Gils 1984). Such problems could be related to fear of loss of power and control. Telemedicine can be of importance for policy issues and, when so, policymakers should be involved.

It is recommended that managers lead change processes in their organizations where the different issues of importance for collaboration are treated and measures are taken to fully realise the telemedicine potential.

The most obvious measures for consideration are the 17 described for teleradiology and the 10 for telemedicine remote consultations.

Telemedicine collaboration requires preparing organizations. For coordination, in general, we find five basic principles: direct supervision, standards and methods, performance output, skills, and mutual adjustment (Hatchuel 1997). On the basis of what has been presented here measures for improved collaboration in telemedicine can be made far more concrete and specific. The most obvious thing to do is to implement described collaboration measures. For organizations, planning telemedicine, it is important to communicate on how the collaboration should be done. They can go through the different steps of the production process and ask questions about which measures are needed. Before starting telemedicine collaboration they should come to an agreement. The agreement can be subjected to monitoring of fulfilment of each partner's obligations, i.e. their use of resources (personnel and equipment) and auditing of quality.

Responsibility for telemedicine can be allocated to a telemedicine working group, procedures and guidelines for use can be published in a form available for all. Such working groups can be cross-professional. In cross-professional groups we have different professions knowledge and knowledge of their working methods. Cross-professional groups can more easily find solutions working for all.

It can be necessary to perform a conscious selection of organizational partners and individuals. Participants must be motivated for telemedicine and the job to be done. It can be wise to limit the number of partners from each organization to reduce the complexity of the communication process (more difficult to agree with many than few), and to obtain a situation of control for monitoring. We also know little about economies of scale and collaboration measures. Selection of organizational partners can be done on the basis of complementarity of resources, alignment of their objectives, similarity in values and culture, and relative strength and size (Schilling 2005). Profiling practitioners according to personality to obtain the best teams may be of help (Brown et al 2002). The question then comes up: Which personal traits are advantageous for interaction in telemedicine?

SUMMARY

Introduction
Health care is fundamentally a collaborative process. Persons working alone do not have all the skills, all the knowledge, and access to all equipment necessary to solve diagnostic and treatment problems. Characteristics of communication are important for health care quality. It is not a matter of course that telemedicine collaboration works well. We need to identify collaboration problems for such telework, and which measures organizations should take for the collaboration to work.

TWO CASES OF TELEMEDICINE ORGANIZATIONAL COLLABORATION

The case of teleradiology collaboration

With teleradiology images can be captured in one organization and transmitted to another for interpretation. Teleradiology requires a minimum of co-operation between participating parties. None of the problems with teleradiology collaboration seem large enough to prevent effective collaboration. Seventeen measures for good collaboration in teleradiology have been identified. The measures are: Someone should be made responsible and tasks distributed, the involved should know one another, problems of attitude should be addressed, management support is important, organizational merger can improve co-operation, organize time for teleradiology at the radiology departments, it may become necessary to redistribute production capacity in between radiology departments, when the volume of experience with teleradiology is high the collaboration is easier, good referrals and good interpretations, quick replies to clinicians, improved schooling of radiographers, thorough learning of procedures, standardisation of procedures and nomenclature, economic and ethical motivations for teleradiology, all work stations of a department should be connected, knowledge of technology among personnel and availability of IT-personnel, and technology problems. For organizations planning teleradiology of a larger volume the collaboration issue is important. A well functioning technology is not enough. The teleradiology potential can only be fully realised if the right measures concerning the collaboration are taken.

The case of collaboration in telemedicine remote consultations

In health care the right competence is not always present at the site of consultation. In telemedicine remote consultations it is often primary care doctors who consult specialists at the hospitals. The 10 measures for improved collaboration are called: experience with remote consultations, meeting at the same time, knowing each other, different personalities, chairman for sessions with several participants, good preparations, make participants responsible and distribute tasks, education and level of education, better co-operation with those who need help, and interest for technology becomes a distraction. Telecommunications do not seem to represent a barrier for good collaboration. Collaboration in telemedicine remote consultations can be made to work well.

GENERAL TRAITS OF TELEMEDICINE COLLABORATION

The general impression is that telemedicine collaboration can be made to work well. Communication technology does not seem to represent an insurmountable barrier for good collaboration. It should be noticed that availability of technology does not automatically result in collaboration. Establishing good collaboration is dependent on implementation of

collaboration measures. For teleradiology and telemedicine remote consultations we find obvious similarities and differences in measures for improved collaboration. In sum close to half of the collaboration measures, for teleradiology and remote consultations, are either similar or have some similarity. For traditional collaboration coordination occurs within location, but across locations for telemedicine. Problems with coordination are critical, but can be solved. This is important for the future of telemedicine.

WHAT ORGANIZATIONS CAN DO

Little telemedicine means a mismatch between activity made possible by the technology and actual activity. Organizations planning larger volumes of telemedicine have a job to do. Inter-organizational collaboration requires involvement of management. It is recommended that managers lead change processes in their organizations, where the different issues of importance for the collaboration are treated. Measures should then be taken to fully realize the telemedicine potential. The most obvious measures for consideration are the 17 described for teleradiology and the 10 for telemedicine remote consultations. For organizations planning telemedicine it is important to communicate on how the cooperation should occur. Managers have great responsibility for telemedicine. Procedures and guidelines can be published in a form available for all. It can be necessary to perform a conscious selection of organizational partners and individuals. Participants must be motivated for telemedicine and the job to be done.

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Chapter 3: Networked regional organization, or the networked health enterprise

Changed organization can result in more telemedicine. A new concept for centralization and decentralization in regions /or large enterprises simplifies analysis of where to locate telemedicine

Introduction

For the implementation of health care policies different countries have chosen different ways of organizing the health sector. The explanation can be found in factors like: history, geography, culture, ideology, economy, and distribution of power. We are dealing with two fundamentally different organizational forms for delivery of health care, public organizations (owned and managed by the state or ownership and responsibility devolved to sub-national levels) and private organizations (for profit, not for profit, religious, and charitable organizations). Since the early 1990ies, with the interest for market models, some countries have implemented organizational forms in-between public and private forms. Publicly owned health care enterprises or corporations, with public competition, are clear examples. The network organization can also be considered as something in-between the market solution and a complete organizational integration with the same hierarchy.

> The complex production in health care is performed by complex organizations and patients can suffer from lack of continuity of care.

The problem of health sector organization is complex and this is related to a complex production. The production process in health care is probably more complex than in any other production. The magnitude of resources used, type of resources, sequencing, and timing of elements of the production process can vary from one episode of care to another. The patients can suffer from a lack of continuity of care. It is in this situation e-health is implemented.

The distribution of functions (examples: acute care and elective care) and medical specialties (examples: dermatology, psychiatry, orthopaedic surgery) between hospitals is important. The need for health care in an area should be covered. For the evaluation of distribution of functions and specialties a number of issues are relevant, for example: what should the principles for the distribution be, which services should be located where, what should the volume of different services be, and what is the right distribution of services between private and public actors? When a new distribution of services is decided how to coordinate the production must be reconsidered. Implementing telemedicine means having a new function, and a new service, added to an already very complex production. Often several organizations and levels will be involved.

Distribution of functions and specialties between providers is decisive for the regional production process. Implementing telemedicine means having a new function and a new service. The question of how to distribute telemedicine functions between providers can look complex.

Network organization is well known from private industry, outside of the health service, but network organization is also relevant for health care. Both when health care organizations collaborate with new technology and when they want to collaborate without such technology (see chapter 4). The concept of organizing health care around electronic networks is easily associated with network organization. Network organization means a formation of alliances between organizations. Alliances can be used to increase an organization's flexibility in what it can do, for example by competence complementation. When health care organizations are organized in networks they can negotiate agreements about sharing resources, new distribution of medical specialties and hospital functions, and mergers. The reason for such behaviour can be found in strengthening of professional communities and quality, improved access to care, and economies of scale.

We know that new technology can be a powerful source of organizational change. Organizational and human problems are the real critical problems when new technology is implemented, and not technical problems.

The health sector can be said to be at an early stage of the changes ICT will bring. The new technology intrudes in a complex organizational setting. We know that new technology can be a powerful source of change. In fact it is not technical problems, but organizational and social issues which are critical in implementation of new technology (Kuhn & Giuse 2000). From international research we find empirical evidence for ICT to have organizational effects (Lorenzi 1999; Lorenzi et al. 1997; Kraemer & Danziger 1990; Meijden et al. 2003; Southon et al. 1997). Telemedicine has the property of reducing the importance of distance and organizational consequences have been proposed and demonstrated empirically (Aas 2001a;b; 2002a;b; c; 2005; Finch et al. 2003; Jennet et al. 2003; May et al. 2003; Spanjers et al. 2001; Weinstein et al. 1997). Predicting organizational consequences of ICT is more difficult (Eason 2000). Organizational effects of new technology can be related to the organizations individuals (for example the existence of champions and persons resisting change), groups (for example profession groups involvement in the change process), and characteristics of the organizations as a whole, like culture, information processes, structure, leadership, control mechanisms (Lorenzi et al. 1997).

Networked organization based on technology

A new situation is created when telecommunications become infrastructure around which services are organized. Single health care providers are distributed around the electronic network. We can speak about networked regional organization, virtual regions, networked health enterprises, or cybercorps. A cybercorp is a virtual organization comprised of a network of separate institutions (Weinstein et al 1997). We can also speak about multinode

organization. When production occurs through electronic networks, involved organizations become organizational nodes.

Progress in the application of telemedicine has been slower than many expected some years ago. This problem should not be overlooked. There is no doubt that many resources have been used, both human and economic. For example a small country like Norway has established an organization with 120 employees for the work with telemedicine. For implementation of large-scale information systems we find high failure rates of 30%, and more (Southon et al 1997). Technology is a necessary precondition for telework, but not sufficient to obtain such work (Ekeland 1999).

Organizational problems are crucial for the future of telemedicine, but have so far been gravely underestimated.

Managers are responsible for forming human networks around the telecommunication infrastructure.

Organizational problems are crucial for the future of telemedicine, but have so far been gravely underestimated. When policy makers have decided to adopt telemedicine, managers must take the initiative to form all necessary alliances, and in a longer time perspective show continuous support to telework. They are responsible for forming human networks around the telecommunication infrastructure. Individual participants (clinicians, nurses, radiologists etc) will work from different organizations and must collaborate with each other. Managers in different organizations must collaborate, managers and clinicians in the same organization must collaborate, and managers and clinicians from different organizations may have to listen to each other. The easiest situation is when all who participate are champions for the technology, but this cannot be counted upon.
When regions (or larger areas in general or large enterprises) are the basis for telemedicine organization, which telemedicine services to have where is relevant. Management can evaluate how different needs shall be covered, control for duplication of services, and if collaborating organizations have their skills pooled. A broad range of competence cannot be available in every organization. Local hospitals can lack the diversification into the high number of specialities, and functions, found in major hospitals. With telemedicine it can be relevant with new evaluation of how many, and which, specialities and functions, local hospitals really need. For example: with teleradiology, radiology departments without their own radiologist are possible. For more complicated cases local hospitals will need the competence of larger hospitals. This can result in local hospitals viewing telemedicine more positively. Major hospitals can view telemedicine a threat to autonomy (Gagnon et al. 2004). Taking the advantage of telemedicine is not just about distribution of functions and specialities, but also about distribution of workload. With regional networks a department, with heavy workload, can leave work tasks over to departments with free capacity. Both demand for a service, and work capacity can vary over time. Decisions to implement telemedicine can be motivated by a wide geographic dispersion of health care providers. It is a problem that geographic dispersion can mean differences in work practices, organization cultures, management styles, and differences in timing of actions. But such problems are not the only perspective. Technology can foster a sense of community among users (Mynatt et al 1997). Virtual teams offer flexibility,

responsiveness and diversity of perspectives. Even more so than co-located groups (Walther et al. 2005).

When health care organizations are connected by electronic networks the potential is present for the episode of care to develop from isolated visits/ stays in the direction of more continuous care. We want the episode of care to become a continuous process of care.

> With ICT we find a potential for the episode of care to become more continuous.

The health service can take the advantage of different applications of new technology (for example electronic patient records, teleradiology, e-mailing of discharge summaries to primary care physicians). This means establishing a situation with a complex combination of technology and organization around the telecommunications infrastructure. Production done with the aid of new technology must then be integrated in (and interact with) a health service where most of the production is done with ordinary work processes.

The virtual organization

With telemedicine we have virtual organizations (see chapter 5 for more about the virtual organization). The virtual organization can be said to constitute a relatively loose network of technology, organizations, and people cooperating on tasks.

> Telemedicine means having a virtual organization. It is not right to conclude that when telemedicine is practiced only now and then we do not have a virtual organization.

A marked hierarchic organization is less relevant for virtual organizations. Virtual organizations easily become flat organizations. With a less clear chain of command participants' values should coincide into a common organizational culture. Cooperation requires that organizational culture and employees' values are not in conflict. Participants should have a common understanding of how to perform the work, be committed to the same objectives, and results. Common information can be promoted by having the same information systems. Leadership can be executed by leaders trusting employees. Employees can to a greater extent lead themselves. Videoconferences can be used for common meetings between cooperating organizations (Jakobsen & Julsrud 1999). The videoconferences can be replaced at certain intervals (for instance once every six months) by ordinary meetings.

Electronic networks decisive for organizational possibilities

The electronic networks determine where telemedicine can be done. Choice of which electronic network to build is basic for the organizational possibilities. In a study (Aas & Geitung 2003) respondents were asked which of the following radiology networks were of interest: local networks at the hospital(s), networks at radiologists' homes, networks at private radiology centres, networks to primary health care, networks where hospitals without radiologist can send images to a department of radiology, networks within the

health region, national and international networks. The respondents considered all eight networks relevant. The two main reasons were related to clinical communication, and improved exploitation of resources.

Personnel involved in telemedicine can view telecommunication networks in regions (larger areas) as the most relevant networks.

Of all networks regional networks were the most popular. Regional electronic networks should have high priority when network cooperation is planned. This is due to improved access to specialised competence (for example the possibility to consult a neuroradiologist at the region's university hospital), and the possibility for improved exploitation of the greater resources found in a region (tasks can be distributed on more organizations).

Regional networks can be connected to national and international networks. Building a national electronic network can be motivated by patient mobility between regions, patients' free choice of hospital, the possibility to exploit highly specialized competence, or even establishing national competence centres. Motivation for using international networks may be found in the possibility for getting second opinion for especially difficult cases. For example, interpretation of radiology images can be carried out in countries with much lower labour costs.

Involvement of different levels of care

It should be noticed that telemedicine does not only mean that different organizations collaborate, but different levels of care can be involved. Implementation of information systems in health care can be of importance for different levels (Ammenwerth et al. 2002). The levels relevant for telework can be an overall organization (e.g. a region, district, hospital, primary care health centre), an organizational unit (e.g. department, section of department, outpatient clinic), a team (e.g. combined radiology/clinical team), and an individual employee (e.g. manager, radiologist, general practitioner). For analysis of future effects of ICT in health care we should map who is taking care of which task now, and who should take care of which task with telework in place. Several factors should be included in the analysis, like: existing flow of services and reengineering of service flow, structure of intra- and inter-organizational communication, distribution of responsibility, and how ordinary production and telework can be made to live well together in the same organization.

A shift in workload and character of work tasks taken care of by different levels of care is of importance for the distribution of economic resources and management of the health sector.

Interaction between levels of care is relevant for several applications of telemedicine. In telehomecare virtual visits can be done by a local health centre, and for remote medical monitoring in the home (by for example ECG and spirometry) readings can be transmitted

to the hospital. Health centre and hospital can then need to communicate. For both teleradiology and telemedicine remote consultations the question of which level of care should perform which task is relevant. For example with teleradiology images can be captured at primary care centres, or routine radiology is transmitted for interpretation from a university hospital (due to capacity problems) to a local hospital. Both examples are definable as shifting tasks from one level of care to another. For telemedicine remote consultations a simple pattern of shift in workload between organizations cannot be expected (Aas 2002c). The explanation can be local variations in how telemedicine is practised. The most general trait seems to be increased involvement for lower levels of care (Aas 2002c). In telepsychiatry some change in distribution of tasks between levels occurs. For example patients can be transferred from mental hospitals to primary care, and follow up is done with telepsychiatry (Aas 2002c). Remote consultations in dermatology can lead to some shift between levels in performance of work, but these changes are hardly large. Examples are that GPs diagnose some patients themselves, and that GPs involved in telemedicine receive patients from other GPs (Aas 2002c). It should be noticed that when we speak about a shift in work between organizational levels we are also dealing with a motivation problem. For the individual doctor remote consultations represent a larger workload than writing referrals to specialists only. What should then motivate for participating in virtual work? For example: being parts of virtual group practices can be an advantage. It can make physicians in rural areas feel less isolated.

Centralization and decentralization

Centralization and decentralization are important terms for all organizing. The terms can be used for sectors of the society and single organizations (like health enterprises or hospitals). Centralization and decentralization are opposite trends on the same scale. Decentralization means “away from the centre” and centralization “towards the centre”. New technology makes the question of centralization or decentralization relevant. Health institutions can be connected in electronic networks with great capacity. The question comes up of where to perform different tasks. In the telemedicine community the solution decentralization of supply and centralization of professional competence has often been mentioned.

For organization of the sectors of society the terms centralization and decentralization are important.

Centralization and decentralization are relevant issues in connection with new technology.

The teleradiology case

Radiology is going through a technology revolution with digitalisation of equipment (Picture Archiving and Communication System), and broadband telecommunications fit for larger volumes teleradiology. The production process in radiology has two completely necessary elements, i.e. capturing of images and interpretation of images. The new technology makes teleradiology far easier than before, and radiologists can have a positive attitude to teleradiology (Krupinski et al. 2003). With teleradiology images can be captured in one organization and transmitted to another for interpretation. The question is not at least where to locate the capacity to interpret images. Images can be captured where the

patient meet, but technically images can be transmitted for interpretation to all connected. The new technology has made centralization and decentralization of radiology relevant issues (Aas 2006a;b).

We have teleradiology specific definitions of centralization and decentralization:

Centralization can be defined as performing all, or parts, of the radiology image interpretation at fewer organizational units than before PACS/ teleradiology.

Decentralization can be defined as performing all, or parts, of the radiology image interpretation at more organizational units than before PACS/ teleradiology.

Definitions of centralization and decentralization have been made especially for the new radiology situation. Centralization can be defined as performing all, or parts, of the radiology image interpretation at fewer organizational units than before PACS/teleradiology. An example is that a region centralizes much of the image interpretation occurring at evening/night/weekends to larger radiology departments. Decentralization can be defined as performing all, or parts, of the radiology image interpretation at more organizational units than before PACS/ teleradiology. An example is that a hospital outsources some image interpretation to a private radiology centre. The private radiology centre then becomes a satellite radiology centre. We have little information about such organizational changes in the new situation for radiology.

In several countries radiology faces some problems, which give reason to ask questions about the location of image interpretation and more teleradiology, like shortage of radiologists, uneven distribution of radiologists, the amount of radiology has increased, and country variations in cost levels (relevant for international teleradiology). The activity of a radiology department is an image of what the hospital is doing. For example much orthopaedic- and surgical-control imaging, much urology- radiology, and much mamma-radiology, show what clinical departments of a hospital are doing.

The new technology makes re-evaluation of distribution of radiology functions relevant, but also distribution of hospital functions and specialties in general can be reconsidered.

It has been proposed that more effective use of technology may require organizational changes (Southon et al. 1997). New organization for radiology can make more teleradiology necessary. For example more teleradiology becomes necessary if duties for nights and weekends are centralized to one hospital of an area. It is not just so that more teleradiology results in organizational consequences. New organization can be a tool for more telemedicine. Without new organization the future volume of teleradiology may become low.

Telemedicine itself is a different production-process, but that is not all. The new technology can give reason for a general reconsideration of distribution of functions and medical specialties between hospitals. A strategy for change common for telemedicine and ordinary production can be developed. The term business process re-engineering is relevant. In business process reengineering strategies are aligned with clarification of needs, plans, priorities, and opportunities (Grimson et al 2000). General distribution of functions and specialties between hospitals, and availability of radiology services are connected. Previously hospitals needed an in-house availability of radiology images, i.e. they needed to capture images themselves, to perform interpretations, and to have images and interpretations available at the hospitals. With PACS and teleradiology this barrier for new organization is less relevant. Radiology images and interpretations can be made available to all connected to the electronic network. Small hospitals can be made into elective hospitals taking care of some groups of patients. Then the radiology activity can be adapted accordingly. For example a hospital specialized in orthopaedic surgery can manage with the capacity of capturing images, and interpretations are done by a major hospital. For emergency care decision can be made that some cases require university hospital care. Decision to transfer patients can be done by first capturing images at the local hospital, then images are transmitted to the university hospital for interpretation. On the basis of the interpretation decision can be taken to transfer, or not to transfer, the patient to the university hospital

Centralization of radiology

For radiology we have a number of types of centralization. There are two extremes: a) complete centralization is done with radiologists only at one hospital in an area, and b) no centralization, i.e. all hospitals have radiologists covering all interpretation needs of their hospital. There are many relevant intermediate solutions. To ease the overview a cross-table is used (Table 1). Centralization types are here put in two main categories: geographic centralization (with three subcategories) and centralization according to function (with seven subcategories). The different subcategories geographic centralization can be combined with the different subcategories of centralization according to function, and the cross-table has 21 (7x3) theoretically possible combinations.

Geographic centralization

Geographic centralization can be of three types:

A) All image interpretation for a geographic area is performed in one location (i.e. radiology department). This is complete geographic centralization.

B) Image interpretation for a geographic area is centralized to fewer locations than before PACS/ teleradiology, but not to one location only.

C) Image interpretation can rotate between several locations. Such rotation may be relevant in connection with 24 hours duties. This can be viewed as geographic centralization because image interpretation at a specific time will occur at fewer locations than before PACS/ teleradiology.

Centralization according to function

Functions may be types of radiology examinations or radiology in different situations. It is for different functions centralization is planned. Centralization according to function may

be complete (subcategory 1) or partial (subcategories 2-7). Partial centralization of functions means that a hospital can both take and interpret images, but transmit some types of examinations or radiology in some situations for interpretation elsewhere.

GEOGRAPHIC CENTRALI-ZATION	**C E N T R A L I Z A T I O N A C C O R D I N G T O F U N C T I O N**						
	All functions	***24 hr duties***	***Radiology specialities***	***Second opinion***	***Functions for a limited time***	***Radiology for referred ambulatory patients***	***Routine radiology***
To one Location	All functions to one location	24 hr duties to one location	Radiology specialities to one location	Second opinion to one location	Functions for a limited time to one location	Radiology for referred ambulatory patients to one location	Routine radiology to one location
To fewer Locations	All functions to fewer locations	24 hr duties to fewer locations	Radiology specialities to fewer locations	Second opinion to fewer locations	Functions for a limited time to fewer locations	Radiology for referred ambulatory patients to fewer locations	Routine radiology to fewer locations
To rotation between several locations	All functions to rotation between several locations	24 hr duties to rotation between several locations	Radiology specialities to rotation between several locations	Second opinion to rotation between several locations	Functions for a limited time to rotation between several locations	Radiology for referred ambulatory patients to rotation between several locations	Routine radiology to rotation between several locations

Table 1 – Centralization of radiology interpretations based on teleradiology. Cross-table of seven subcategories of centralization according to function against three subcategories of geographic centralization, showing 21 theoretically possible combinations. Functions represent types of radiology examinations or radiology in different situations.

1) Centralization of all functions to one location, i.e. images of all types and in all situations are transmitted for interpretation to one radiology department (this subcategory is the same as geographic centralisation subcategory A). Other locations have the capacity to capture images only (they have radiographer and no radiologist), and clinicians at such hospitals can discuss cases with the radiologist by telephone (and with PACS view images simultaneously). If it is right to centralize radiologists away from a radiology department depends on the needs a department should cover. Some specialised hospitals have a limited need for own radiologist.

2) Centralization of 24 hours interpretation duties means fewer hospitals have such duties. A radiology department receiving images for interpretation can be called a duty-centre. At smaller hospitals little may occur during night /evening/ weekends requiring a radiologist on duty. Teleradiology makes it possible for one radiologist to interpret for several hospitals.

3) Specialisation based centralization. Teleradiology makes it possible to transmit images for evaluation by a specialist at another hospital. The location receiving images can be called a competence centre. For radiology specialisation can occur on the basis of organ system (e.g. neuroradiology), modality (e.g. MR) or type of examination.

4) Second opinion centralization. Distribution of competence may make it relevant to send images to another hospital for second opinion. With new technology the volume of second opinion may increase. Much use of second opinion can be considered a form of centralization. Locations receiving many images for second opinion get an increased volume of interpretation. Relative distribution of volume of interpretations between locations is changed.

5) Time limited centralization. Some hospitals may have time limited capacity problems connected to general shortage of radiologists, vacant positions, leaves and holidays. In such situations transmitting images to other locations for interpretation constitutes an important alternative.

6) Centralization of radiology for referred ambulatory patients. When a patient is referred for radiology, for example from primary care, images may be transmitted to another location for interpretation. Interpretation does not require the presence of the patient.

7) Centralization of routine radiology. Interpretations of routine character can be transmitted to what can be called an interpretation centre.

ADVANTAGES WITH CENTRALIZATION

Centralization of radiology interpretations may imply advantages, like:

1) Better distribution of workload.

2) Improved quality of image interpretation.

3) Advantages of economic nature,
i.e. centralization of radiologists' duties, economies of scale, abolishment of radiologist travels, and less short time hiring of radiologists.

1) Better distribution of workload
With teleradiology a complete rethinking of the distribution of radiology work tasks, for larger regions or in larger enterprises, is possible. Teleradiology makes it possible to better exploit total capacity for image interpretation. We can re-evaluate which location should perform which radiology with which workforce. Not at least in countries with shortage of radiologists it is important to take full advantage of the work force. The combination of shortage of radiologist at one department, and free capacity at another, is an invitation to teleradiology. Reconsidering the organization of 24 hours duties in-between hospitals, of a larger area or larger enterprise, could include who should take care of the duties (for example centralization of 24 hour duties to one hospital, rotation of the duties in-between some or all hospitals), the question of avoiding duplication of duties, and specialization of duties (for example all neuroradiolgy taken care of by one hospital in a larger area).

2) Centralization and quality
Teleradiology represents a possibility for building up centralized specialised competence. Then centralization may result in improved quality image interpretation. For sites, with one or few radiologists, having top competence in all areas of radiology can be difficult. When radiology procedures for the same problem are different at different hospitals, images will be accordingly different. Greater flow of images may result in greater similarity of procedures (Aas 2005). Degree of similarity in medical practise is in international research used as an indicator of quality. Images for several sites can be stored in one common computer. Such archives can be used for the pathology comparisons, or to follow a single patient's history of disease, and may play a role for quality.

3) Advantages of economic nature
To make the cooperation in teleradiology work a number of measures should be taken (see chapter 2). With large volumes of teleradiology transaction costs increase, and gained benefits must be greater than the cost increase (Pelletier-Fleury et al. 1997). Transaction costs should be observed. On the other hand if future volume of teleradiology becomes low, this touches the question of the profitability of the high investment costs for new telecommunications and PACS (Singh & Williams 1997). Possibilities exist for economic gains by centralizing, but the possibilities have not been much subjected to economic analysis. Economic gains can be achieved in several ways, for example:

Centralization of radiologists' duties: with the technology radiologists' competence can be available independent of time and place. Having 24-hour duties at all hospitals implies high costs. At small hospitals with a low workload 24 hour duties are expensive, and transferring duties to other hospitals may reduce costs. Especially during nights total work load at smaller hospitals can be low. Centralization of 24 hour interpretation duties can also be an advantage for smaller hospitals which, due to shortage of radiologists, have problems with continuous availability of the interpretation function.

Economies of scale: advantages with economies of scale are obtained when costs are reduced per unit produced, when the size of producing organization increases. Improved economies of scale can be achieved by better exploitation of equipment, personnel and buildings. We know little about economies of scale connected to teleradiology. Economies of scale information for departments with 'ordinary' production is not necessarily applicable. Better exploitation of radiologists work capacity means improved economies of scale. Changes in economies of scale can also be achieved by specific organizational solutions. For example when radiology departments are merged and they manage with a simpler administration.

Abolishment of radiologist travels. Some hospitals can have shortage of radiologists due to general shortage of radiologists, sick leaves etc., or the hospital is too small to have its own radiologist. A traditional solution has been for radiologists to travel to the hospital, but both travel and time cost. Transmitting images results in fewer radiologist travels, and the radiologist can use considerably less time to do the same job. This can lower the costs (Bergmo 1996).

Less short time hiring of radiologists: when a radiologist position is vacant a substitute can be hired from manpower agencies, but the costs are high. This is a well known problem in a country like Norway. With teleradiology such hiring of radiologists can be reduced and the costs are reduced.

DISADVANTAGES WITH CENTRALIZATION

Centralization of image interpretation implies disadvantages limiting the possibilities for centralization.

Disadvantages with centralization can be related to:

1) Required presence of radiologist.

2) Changes in radiologist's contact with clinician and patient.

3) Weakening of hospitals' professional community.

4) Clinico-radiological conferences become more difficult to organize.

5) Needed standardization of procedures.

6) For inpatients and ambulatory patients close contact between radiologist and clinician more difficult.

7) Quality. It is not a logical necessity that centralization results in better quality image interpretation.

8) For hospitals with heavy workload duties teleradiology become an additional burden.

9) Centralization takes resources from the periphery.

1) Required presence of radiologist
With extensive centralization some hospitals will not have a radiologist. They cannot perform procedures requiring the presence of a radiologist. Then patient travels for such types of radiology become long. The situation limits the possibility for centralization of image interpretation. Clear examples are intervention radiology with its vascular and non-vascular procedures (Jenssen et al. 2003), and nature and severity of major trauma make the presence of a radiologist important (radiologists can as doctors evaluate the patient medically and the need for radiology).

2) The radiologist's contact with clinician and patient
Radiology includes communicating with clinicians and patients. With centralization increased distance to clinicians may necessitate more time to communication. Radiologists want information about the patient problem and this is not always well described in referrals. For hospitals with many emergencies, decisions must be taken immediately. Clinicians want quick interpretations and communication with radiologist about diagnosis and treatment. In Norway diagnosing and treating patients is increasingly the result of a teamwork which includes radiologists. If radiologists are centralized away from some hospitals such teamwork will become more difficult to obtain. With centralization radiology becomes more like screening, and then radiologists may think they stop being physicians. Problems with recruitment to radiology may result.

Centralization of image interpretation increases distance between radiologist and patient. The radiologists will more rarely see patients, and increased distance to the clinic may be viewed as a disadvantage.

3) The hospital professional community
In hospitals we find a complex professional community with many professions and specialities. When centralization means that some hospitals will be without radiologist the hospital professional community can become weaker from less interaction with radiologists. Hospitals without radiologist may get problems with the recruitment of clinicians. Both clinicians and radiologists can view themselves being parts of cross-professional teams as advantageous. For radiographers the co-operation with the radiologist can be important. With no radiologist present they must trust their own evaluation of image quality. Variation in work tasks may contribute positively to radiologists' job satisfaction. Centralization can make radiologists' work tasks at small hospitals less varied, but teleradiology can also be used to make radiologists' work tasks at small hospitals more varied.

4) Clinico-radiological conferences
Radiology departments can organize daily meetings with doctors from clinical departments, i.e. the clinico-radiological conferences. Clinico-radiological conferences may be of importance for the quality of image interpretation (Aas & Geitung 2004). At these conferences radiologists obtain an understanding of the clinicians' thinking. Organization of clinico-radiological conferences becomes more difficult if image interpretation is centralized. An alternative is to organize clinico-radiological conferences as videoconferences. Such videoconferences can be supplemented with face-to-face meetings, a few times a year, to maintain contact between the involved.

5) Standardization of procedures
Centralization increases the need for standardisation of procedures (Aas 2005) (standardisation is also treated in chapter 2 point 13 in measures for improved collaboration in teleradiology). For the radiologist performing an interpretation it is important to know how the images were obtained. A solution can be that radiology departments use the same radiology procedures. Standardized procedures make it easier for a region to centralize interpretation of images. Without standardization radiologists interpret images obtained by procedures they are not used to. For example when a radiologist finds an interpretation problematic he may need to call back to know how the images were obtained, or tell the sender to use a different procedure. This takes time. Centralization also makes standardised nomenclature important. In international teleradiology (Robinson et al. 2003) attention must then be paid to international standards for radiology procedures.

6) Inpatients and ambulatory patients.
In connection with inpatients centralization of image interpretation to other hospitals is not an advantage. Close contact between radiologist and clinician makes image interpretation easier. It is easier for the radiologist to obtain answer to what has happened with the patient, and what will be done next. But centralization in connection with inpatients is not excluded. Highly specialised hospitals (for example performing only orthopaedic surgery) can have a lower need for close contact between radiologist and clinician.

Images can be taken of patients referred to the radiology department, for example from primary care. Transmitting images for interpretation is easier when the problem is less serious (for example images of a patient with a little pain in the hip), or simply does not require hospital treatment.

7) Quality
Quality must be a part of centralization considerations. In a region competence profiles among radiologists can vary from department to department. The new technology situation can be used to develop different competences at departments. Taking the advantage of this possibility may promote quality. It is not a logical necessity that centralization results in better quality image interpretation, but it may also become lower. Lack of contact with clinicians can play a negative role, but there are also other factors. When centralization implies that interpretation is done after the patient has left for home (for example for ambulatory patients), supplementary images, or new images for improved image quality, will not be possible.

8) Hospitals with heavy workload duties

For hospitals with heavy workloads teleradiology can become an additional burden. Especially at university hospitals workload for radiology departments can be heavy in the evening and at night (more patients severely ill). Receiving teleradiology does not make the situation easier. Duties can become more tolerable if some work tasks are transferred to other hospitals or private radiology centres. For example routine interpretations can be performed by radiologists on duty at less busy smaller hospitals, and CT and MR by radiologists (with special competence) at local hospitals. Another solution is to reconsider the distribution of positions for radiologists in-between hospitals of a region. When teleradiology comes on top of a heavy workload employment of more radiologists can be necessary.

9) Centralization takes resources from the periphery
Image interpretation can be (but does not need to be) centralized to major hospitals. It is equally technologically possible to transmit images for interpretation to rural hospitals. This can be especially relevant if smaller hospitals have free capacity, for example in connection with 24 hour duties. Teleradiology can be used to consolidate the situation at small rural hospitals, with less volume of image interpretation, but still with a need for 24 hour duties.

Decentralization of radiology

For decentralization we find fewer types than for centralization. Decentralization is considered less relevant for radiology than centralization. Decentralization to a higher number of organizational units would drain already small departments for radiologists. Many small organizations can be more difficult to coordinate for improved exploitation of total regional resources, measures to obtain good cooperation become more encompassing (Aas 2005), and good information systems will be required. Small organizations are also more vulnerable to, for example, sick leaves.

Decentralization of radiology seems less relevant than centralization, but some types of decentralization can have a role to play, like:

More interpretations at smaller hospitals.

Decentralization of duties to smaller hospitals.

Workstations in radiologists' homes.

Outsourcing to satellite (for example private) radiology centres.

Mobile technology solutions.

Workstations at surgical departments.

International teleradiology.

Decentralization of capturing radiology images, for example to primary care centres.

DECENTRALIZATION FORMS WITH A ROLE TO PLAY

More interpretations at smaller hospitals

When all hospitals are connected all can be suppliers of interpretations. It becomes possible to have specialized expertise in rural areas, and this may help in keeping well-qualified personnel at local hospitals. Patients can be treated at hospitals with the shortest waiting time. MR images can be captured in one location, and interpreted in another. In case of vacancies due to illness, or general shortage of radiologists, images can be transmitted to other sites for interpretation.

Decentralization of duties to smaller hospitals

Duties at evening/ night/ weekends can rotate between radiology departments. Respondents in a study (Aas 2006b) told that managers and politicians may go for this because savings are possible, but also to have more varied work tasks at small departments.

Workstations in radiologists' homes

Workstations in radiologists' homes increase flexibility for where and when interpretations can take place. When more doctors have responsibility for children this can be advantageous. Employees working from home are perhaps the most decentralized form of telework. Workstations in radiologists' homes are examples of telecommuting (i.e. substitution of the daily commute with communication by a computer).

Research from other sectors show that individuals performing telecommuting can be highly motivated. Responsibility for children can motivate for greater flexibility in the work situation (Chapman et al 1995). Positive job characteristics with home-based teleworking can be: greater job autonomy, increased performance, less work related stress, and reduced commuting (Sparrow & Daniels 1999). Self-reports show up to 40% increase in productivity by working from home. This is due to fewer distractions (Cascio 1999). But telework from home does not just imply advantages. We can find: increased social isolation from work, increased home work-role conflicts, with time flexibility in skills can be reduced (Chapman et al 1995), longer working hours, increased perceived work demands, poorer physical working conditions, less social support at work, poorer social position, social isolation, and fewer career opportunities (Sparrow & Daniels 1999). For personnel working from home their work will be less visible to their manager, and the work may be considered of less importance for own organization. Management will have to find ways to plan task assignments, assess competence, provide feedback, and performance of work will be under more complex influence (Mohrman 1999). For home-based telework a few days per week should be spent at the office. This seems to work best. Then personnel can interact normally with managers and colleagues (Cascio 1999).

Outsourcing to satellite radiology centres

In outsourcing contracts are made with external organizations for some of the workload (for example with private radiology centres or other radiology units). Radiology departments do not necessarily have all work capacity, and all competence, necessary to take care of all requested radiology. With outsourcing radiology departments can liberate capacity for other tasks. Outsourcing can be relevant for routine radiology, radiology for outpatients, some workload in periods with high workload, radiology for clinical problems requiring more specialized competence, or especially MR can be outsourced. The new

technology has made outsourcing of interpretations to private radiology centres well known in for example Norway.

Mobile solutions
In future, mobile technology will have sufficient capacity for transmitting radiology images. Images can be interpreted irrespective of radiologist location, but quality and confidentiality must be good.

Workstations at surgical departments
Hospitals may have small radiology workstations at surgical departments. Some surgeons scrutinise images (for example fractures) they have responsibility for. Distribution of work tasks between surgeons and radiologists can then be re-considered.

International teleradiology
Images may be transmitted to other countries for reasons like lower cost level and lack of radiologists.

Decentralization of capturing radiology images
The capacity to capture images can be established in primary health care (Salvador et al. 2002). This can be relevant in communities with a larger population, without hospital. Some rural areas can also have an extra need for radiology (for example ski-resorts with many fractured legs). Capturing of images in primary care requires employment of a radiographer. The primary care centre can share a computer, for storing images, with the hospital interpreting images. With long distances, and larger patient volumes, capturing images in primary care centres can result in cost savings (Halvorsen & Kristiansen 1997; Johansen & Breivik 2004). When images are captured in primary care radiologists rarely consult the GPs before writing interpretations, and the GPs rarely consult the radiologists to clarify aspects of the interpretation (Salvador et al. 2002). Consultations between clinician and radiologist on interpretations are well known in hospitals.

ADVANTAGES WITH DECENTRALIZATION

Decentralization can imply some advantages, like:

1) Improved exploitation of capacity and competence.

2) New distribution of functions can be an advantage for patients.

3) Capturing radiology images in new locations.

4) Taking advantage of local competence.

5) Rural policy considerations, like wishing to keep parts of the population in rural areas, and support to local hospitals.

1) Exploitation of capacity and competence

More radiology is now done, but without a corresponding increase in number of radiologists. Work pressure on radiologists has increased. Some radiology departments can find it difficult to cover the increased demand. For improved exploitation of capacity reconsidering distribution of work tasks in regions is important. The networks can also be professional networks of importance for small departments. A more varied competence is made available.

2) Distribution of functions and the patients
With the new technology reconsideration can occur for distribution of medical specialties and general functions (for example emergency care and elective admissions), and radiology functions (capturing of images and interpretations) in between hospitals. An episode of care may consist of visits to different sites and patients can be allocated to the site with the shortest waiting time. This necessitates good information systems.

3) Capturing radiology images in new locations
The technology makes it possible to take images at locations previously without such capacity. For patients this can mean the advantage of a shorter travel.

4) Local competence
Radiologists at local hospitals know their patients and view things more holistic. Radiologists at major hospitals can get feed- back from local radiologists about quality assurance and mistakes they have done.

5) Rural policy considerations
Decentralization can be motivated by general political considerations, like wishing to keep parts of the population in rural areas, and support to local hospitals.

DISADVANTAGES WITH DECENTRALIZATION

Decentralization can imply some disadvantages, like:

1) Weakening of professional communities.

2) Less commitment and motivation.

3) Less contact between radiologist and clinician.

4) Problems with supply of personnel.

5) Lack of information about patients.

6) Increased work with organization and cooperation.

7) With home workstations increased distance to own professional community and demand for their workforce can become a problem.

8) Standardization becomes more important, and the possibility for a heterogeneous

practise of radiology is increased.

9) Confidentiality may be a problem.

1) Professional communities
Decentralization implies splitting professional communities, resulting in smaller and weaker professional communities. Direct contact with resource persons is reduced. Centralization contributes to strengthening of professional communities.

2) Commitment and motivation
Decentralization can make radiology departments small, less stimulating, and employees less committed. Lack of commitment can also be the result for international teleradiology. For small departments absence makes employment of radiologist substitutes relevant. When employed for a week or two, they represent the opposite of a locally committed radiologist.

3) The contact between radiologist and clinician
With decentralization the close contact radiologist t– clinician disappears. This may result in reduced quality diagnostics.

4) Problems with supply of personnel
When specialized work tasks are decentralized, and stability in the work force low, a risk exists for the niche not to be well taken care of.

5) Lack of information about patients
Decentralization requires access to information from different locations (for example the electronic patient record). Radiologists may have to diagnose cases where things have been done earlier, and they know nothing about it. During interpretation the radiologist can be in need of additional information and images, and this becomes more difficult to obtain.

6) Increased work with organization
Splitting workload on more sites may result in interpretations being finished later. Increased work with organization and cooperation (Aas 2005) will not pay with a small volume teleradiology. A precondition for decentralization is that it must be more long-term binding.

7) Home workstations
Workstations in radiologists' homes are possible and some hospitals have such arrangements (especially for duties). For distance workers high demand for their workforce can become a problem. Workstations in radiologists' homes may result in increased distance to own professional community, and they do not follow the development of their speciality. Then, qualifications can be questioned.

8) Standardization
Teleradiology makes standardisation of procedures necessary. Radiologists can be used to perform examinations in their own way, but with standardisation they cannot decide

themselves. Decentralization to more organizational units increases the possibility for a heterogeneous practise of radiology.

9) Confidentiality
Access to images should be restricted for confidentiality reasons, but it becomes too complicated if hospitals cannot retrieve images in each other's PACS archives. Access for unauthorised personnel to computerised databases represents a safety problem.

Extension of the new concept for regional radiology organization to other telemedicine applications

Empirical research has changed the image of organizational effects of telemedicine considerably (for example Aas 2001 a;b; 2002a;b; 2005; 2006a;b). Fundamental traits of potential new regional organization for radiology is described in some detail in this chapter. When it comes to organization of other telemedicine the radiology case is a useful model. Analysis of future regional organization of telemedicine can be based on centralization and decentralization thinking. By doing so the organizational analysis is simplified considerably. The new model implies a considerable change in thinking.

Radiology can be considered a useful model for organization of telemedicine in regions or large enterprises.

The central role of centralization and decentralization simplifies considerably the analysis for future regional organization of telemedicine.

Knowledge with the general structure developed here (overview of centralization and decentralization potential, advantages, and disadvantages) should be built up for other applications of telemedicine.

When work-processes can be split and occur in different sites centralization and decentralization can be considered for work to be done on both sides of the electronic network.

Cross-tables can be built up for other applications of telemedicine than radiology (for both centralization and decentralization). Such cross-tables will give an overview of alternatives for organizational change. For decentralization of radiology interpretations this has not been done here. Relevant decentralization alternatives are fewer and overview is more easily obtained.

The remote consultation is a well-known application of telemedicine. It is not applicable in all specialties. Especially not when direct examination of the patient is important, or when a wide scope of clinical information is necessary (Lehoux et al 2002). Well-known applications of the remote consultation are in psychiatry, dermatology, otolaryngology, and frozen section pathology service. In future, when live remote consultations are possible from any PC, remote consultations will be easier to achieve. The centralization and decentralization thinking can then have increased relevance for remote consultations. We

need to develop definitions of centralization and decentralization specific for remote consultations. For centralization of an application we need to decide which types of geographic centralization are relevant, and which types of functions are relevant. A cross table will then show types of geographic centralization against types of functions, and the different centralization alternatives. An overview of organizational alternatives is obtained. Cross-tables can show different degrees of detail. For example for telepsychiatry: which organization should take care of just one category psychiatric patients (then a cross-table may not be necessary to obtain overview), or the distribution of a set of categories on several organizations.

Telemedicine can mean decentralization of supply and centralization of competence. For traditional specialist referrals primary care doctors can establish a referral network consisting of a set of specialists. This network can be stable over time (Lehoux et al 2002). If centralization of competence is done for telemedicine, primary care doctors can be forced to change whom they refer patients to. When a naturally developed referral network is not respected, the GPs can choose traditional referral to telemedicine remote consultation. The alternative is that GPs can have remote consultations with whomever they want. To make highly developed specialist competence more easily available for GPs lists of specialists, with competence profiles, can be made

The centralization and decentralization thinking described for teleradiology and telemedicine remote consultations relevant for other applications of telemedicine. Application specific definitions for centralization and decentralization must then be made. Centralization and decentralization can be considered for work occurring on both sides of the electronic network. Then necessary separate cross-tables, for work to be done on both sides of the electronic network, can be made. Knowledge with the general structure described here, i.e. overview of centralization and decentralization potential (cross-tables), advantages, and disadvantages should be built up for other applications of telemedicine. Regional managers should stimulate work to obtain such information. This can be of help in future evaluations of organizational changes.

The new situation has potential to shift interest over to more market thinking. In countries with public health care market thinking can become more relevant. Location of where work takes place can be decided by organizations competing for contracts. For example in radiology the contracts can be about total annual production of interpretations (relevant for a highly specialized hospital without radiologist which needs others to perform its interpretations), or a part of the production (for example for interpretations outside of ordinary working hours only). Payment can be done on the basis of knowledge of historical costs, by fee-for-service, or by fee-for-service within the limits of a specified production volume. It should be noticed that transitions to more market thinking is not the only alternative possible. A different alternative is transition to network organization.

What regions or large corporations can do: organizational change for more telemedicine

The present chapter starts with a description of the complexity of production in health care and the corresponding organizational complexity. For telemedicine the developed concept for centralization and decentralization cuts through the complexity, and simplifies organizational considerations for more telemedicine in regions or large enterprises.

For full realization of the telemedicine reorganization potential centralization and decentralization are important.

The potential for tele-cooperation can only be fully realized if appropriate reorganization measures are taken. Implementing PACS and teleradiology can be considered a mal-success if centralization and decentralization are not considered. Having PACS at all radiology departments of a country, and building telecommunication networks for health care, with great capacity, implies high investments. One reason for investing in PACS is found in teleradiology. With low volume of use high costs must be distributed on few transmitted images. The situation does not become better if all applications of telemedicine have a limited use. Having other types of telemedicine also means investments. In fact the question can be asked if we would be better off without investing in telemedicine, when working in the traditional way pays.

Planning change

To obtain an overview of all organizational alternatives cross- tables can be made, i.e. cross-tables for each telemedicine application.

Local information about the situation in own region, or own enterprise, should be obtained.

Action plans should be made with identification of relevant changes, and a timetable for the changes.

Management must see to that telemedicine does not just come on top of a heavy workload. Employees can resist telemedicine.

Organizational changes will be decisive for the future volume of telemedicine. Planning of the change process requires an action plan with identification of relevant changes, and a timetable for the changes. Local information about the situation in own region, or own enterprise, can be obtained by qualitative interviews of respondents (for example from a region's radiology departments), and focus group interviews (with more focus on a region's total telemedicine organization). A set of cross-tables for centralization alternatives (and decentralization alternatives) can be developed, i.e. cross-tables for each telemedicine application. The goal is to obtain an overview of all organizational alternatives. After scrutiny an organization may find that for example not all 21 alternatives in Table 1 are equally relevant for own organization. An evaluation can start with excluding obviously less relevant alternatives. The following evaluation will then be simpler. It may be wise to make a plan for change consisting of smaller steps, sequenced with criteria for when the next step should be taken. We know little about how encompassing future organizational changes based on telemedicine will be. More research is needed to understand what really decides how far different organizations will go. For organizational changes based on new technology managers should play an important role.

Management must see to that telemedicine does not just come on top of a heavy workload. When workflow has not been adapted to existing resources, workload and time pressures for users increase. If time is not cleared for telemedicine employees cannot be expected to be positive.

Strategy for change

For successful ICT implementation it can be advantageous to work out a strategy (Lorenzi et al. 1997; Southon et al 1997; Spanjers et al 2001). In strategic management decisions are taken on how to make an organization survive, and progress, in a changing environment. It is about taking the right decisions for the future.

> The work with an action plan should include development of a strategy for the change in organization.

A strategy can mean working out: 1) what the objectives of the new organization should be, 2) decide what should be long-range and short-range objectives, 3) decide how the objectives should be reached with which resources, organized in which way, with which management processes, with which roles for different organizational units and persons. 4) The strategy can then be implemented, 5) performance evaluated at intervals, situational factors reviewed, and corrections done when necessary.

Organizations need to analyze which blend of telemedicine applications and traditional services is the right one. Integrating ordinary and virtual health care delivery is not necessarily easy. In planning of implementation available resources, situational factors, and strategy objectives should be aligned into one total plan for the future. Problems with IT implementation processes can be due to poor planning.

Selection of partners

The success of collaboration is dependent on partner selection. Several factors can be important for how well organizations fit to each other, like relative size and strength, complementarity of resources, alignment of objectives, and similarity in values and culture (Schilling 2005).

> Select the right partners for the collaboration.

Perceived organizational need for collaboration should not be forgotten. Compatible objectives of the organizations must be balanced against their incompatible objectives (van Gils 1984). For telemedicine to succeed effective change management is necessary to address personnel's worries about roles and responsibilities (Gagnon et al. 2004). Organizations, managers, and all personnel involved should be motivated for the change.

Continuity of care

Continuity of care for patients in need of treatment from several organizations is a problem. Not at least so for some groups of the chronically ill. Technically, it is possible to make electronic patient records (EPRs) accessible across levels of care. The EPRs can be equipped with reminders and standards for case management from evidence based medicine. For patients, in great need of care, electronic individual care plans can be made. A care plan can have information on type of need, and who should take care of which need.

Exploiting new technology has the potential to improve continuity of care.

Personnel both in primary care, and hospitals, can then have the same information, make input to the same standard for production line, and will be alerted in the same way. Together with timely and good discharge abstracts this can make cooperation easier and improve continuity. Patients are increasingly diagnosed and treated by teams. When team members work in the same hospital it is easy to forget that the collaborators have access to the same information (the EPR). When members of a team are not co-located sharing information becomes more difficult. The problem can be solved by making the EPR, and individual care plans, available irrespective of location, but also by communication between participants (electronic messaging, telephone, videoconferences).

The organizational networks

Health care organizations should develop competence in organizational networking. For management in larger health regions (or major health enterprises) the challenge will be to find solutions acceptable for different organizational units and organizations. Search for solutions where all have something to gain may be a natural answer. This may mean a redistribution of incomes, costs, and gains for involved organizations. The total organization can be worse off if a changed organization works against management. Network analysis based on individual actors' interests only, can create suboptimal solutions for the total network.

Managers must develop competence in what it means to manage a network.

How well a network organization works can depend on coordination measures, the feeling of shared goals, skill and knowledge development.

A network organization can be dynamic with organizational units as organizational building blocks, which can be configured into shifting relationships and structures.

It may be correct to perform analysis based on an overview of the possibility for gains by the total network. How well a network organization works can depend on its ability to coordinate the production process, the feeling of shared goals, skill and knowledge development. A network organization has the potential to provide intangible benefits, like

extension of employee networks, exchange of information about new developments, create broader knowledge, obtain different and more experience. We can speak about a network health sector. The network can be dynamic with adaptability to shifting requirements. In a network autonomous units can be considered as organizational building blocks, which can be configured into shifting relationships and structures both within and across organizational borders, with shifts in demand, strategies, and treatment patterns for episodes of care. Compared to a traditional organization the network allows more specialization and better exploitation of developed specialized competence. When telecommunications functions as an infrastructure around which services are organized several issues must be treated, like: the number of organizational units involved in producing telemedicine, hierarchic levels in the new organization, who should be responsible for which telemedicine network, how telemedicine should be integrated and interact with production done by ordinary work processes, and reporting systems in the new organization.

Some problems

Although the total potential for change is large, predicting actual organizational changes is difficult (Finch et al. 2003; May et al. 2003; Buxton 1999; Karasti et al. 1998). A simple cause and effect model for ICT and organizational outcomes is of little interest. One and the same technology can have different consequences in different organizations (Eason 2001). Organizational restructuring, including centralization, may cause some individuals to lose position and others to gain a better position. This may cause tension when restructuring is planned. Organizations working together in networks may face problems, but also see reasons for continuing such work (Alter & Hage 1993; Finsrud 2004). Much telemedicine means much virtual work, but virtual organisations are not problem-free (see chapter 5). For the cooperation in telemedicine to work a number of measures are required (see chapter 2). Financing methods and legislation can influence cooperation. If much workload is shifted in between sites employees may have to change location where they work, and this may cause protests. In addition we know little about how well large volume virtual work fit together with traditional work processes in the same organization. We have little information on transaction costs for collaboration based on new technology. ICT has the potential to lower transaction costs, for example by integrating information systems (Ferguson & Keen 1996), but this is not likely to be independent of collaboration volume.

SUMMARY

Introduction
Telemedicine has the property of reducing the importance of distance and organizational consequences have been proposed and demonstrated empirically.

Networked organization based on technology
In the new situation we can speak about networked regional organization, virtual regions, networked health enterprises, cybercorps, and a multinode organization. Organizational problems have so far been gravely underestimated.

The virtual organization
Telemedicine means having a virtual organization.

Electronic networks decisive for organizational possibilities
Choice of which electronic network to build is basic for the organizational possibilities. Of all networks regional networks are the most popular.

Involvement of different levels of care
Shift in workload and character of work tasks taken care of by different levels of care is of importance for the distribution of economic resources and management of the health sector.

Centralization and decentralization
Centralization and decentralization are relevant issues in connection with new technology.

The teleradiology case
Centralization can be defined as performing all, or parts, of the radiology image interpretation at fewer organizational units than before PACS/teleradiology. Decentralization can be defined as performing all, or parts, of the radiology image interpretation at more organizational units than before PACS/teleradiology. New organisation for radiology can make more teleradiology necessary.

Centralization of radiology
Totally 21 theoretically possible types of centralization of image interpretation have been identified. In a cross-table different subcategories of geographic centralisation are combined with the different subcategories of centralisation according to function, and show the 21 (7x3) combinations (see table p.64).

ADVANTAGES WITH CENTRALIZATION
1) Better distribution of workload. 2) Improved quality of image interpretation.
3) Advantages of economic nature.

DISADVANTAGES WITH CENTRALIZATION
Disadvantages with centralization can be related to:
1) Required presence of radiologist. 2) Changes in radiologist's contact with clinician and patient. 3) Weakening of hospitals' professional community.
4) Clinico-radiological conferences become more difficult to organize.
5) Standardization of procedures will be more important. 6) For inpatients and ambulatory patients close contact between radiologist and clinician more difficult to obtain. 7) Quality.

It is not a logical necessity that centralization results in better quality image interpretation. 8) For hospitals with heavy workload duties teleradiology can become an additional burden. 9) Centralisation takes resources from the periphery.

Decentralization of radiology

Decentralization is considered less relevant for radiology than centralization.

DECENTRALIZATION FORMS WITH A ROLE TO PLAY

More interpretations at smaller hospitals, decentralization of duties to smaller hospitals, workstations in radiologists' homes, outsourcing to satellite radiology centres (for example private), mobile technology solutions, workstations at surgical departments, international teleradiology, and decentralization of capturing radiology images (for example to primary care centres).

ADVANTAGES WITH DECENTRALIZATION

Advantages can be related to: 1) Better exploitation of capacity and competence. 2) Distribution of functions and the patients, patients can be allocated to sites with shorter waiting time. 3) Capturing radiology images in new locations, shorter travel for patients. 4) Local competence. 5) Rural policy considerations

DISADVANTAGES WITH DECENTRALIZATION

Decentralization can imply some disadvantages, like: 1) Weakening of professional communities. 2) Less commitment and motivation. 3) Less contact between radiologist and clinician. 4) Problems with supply of personnel

5) Lack of information about patients. 6) Increased work with organization and cooperation. 7) With home workstations increased distance to own professional community and demand for their workforce can become a problem. 8) Standardization more important and the possibility for a heterogeneous practise of radiology is increased. 9) Confidentiality may become a problem.

Extension of the new concept for regional telemedicine organization to other applications

Knowledge with the general structure developed here (overview of centralization and decentralization potential, advantages, and disadvantages) should be built up for other applications of telemedicine. We need to develop application specific definitions of centralization and decentralization.

What regions or large corporations can do: organizational change for more telemedicine

For the telemedicine situation the developed concept for centralization and decentralization cuts through the complexity and simplifies the organizational considerations for more telemedicine in regions or large enterprises.

Planning change

A set of cross-tables for centralization alternatives can be developed. One cross-table for each telemedicine application.

Strategy for change

Organizations can work out strategies for change.

Selection of partners
The success of collaboration is dependent on partner selection.

The organizational networks
A network organization can be dynamic with organizational units as organizational building blocks, which can be configured into shifting relationships and structures.

Continuity of care
Exploiting new technology has the potential to improve continuity of care.

Some problems
Although the total potential for change is large, predicting actual organizational changes is difficult.

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Chapter 4: The network organization

Research on general network organization is well known from the history of organization theory. Distance collaboration based on the telecommunications infrastructure means network organization. Health care has something to learn from general network research

Introduction

Network organization is nothing new and something connected to new technology only. Network organization is a well-known issue in international organization research. The history of the concept of networks in organizations dates back to the 1930ies (Nohria 1992a). Inter-organizational networks gained increased importance in the late 1990ies (Chisholm 1998). It has even been proposed that the days of the hierarchic corporation are over, to the advantage of the network form (Grimshaw et al. 2005). In the US network organization already involves a significant part of the health service (Rosko & Proenca 2005; Ortiz et al. 2005; Ford et al. 2004; Weil 2000). The health service of today requires more collaboration between providers (Edwards 2005).

Compared to 100 years ago, 50 years ago or even 30 years ago we live in a world with a continuous knowledge explosion. To be competitive, firms need to take advantage of new knowledge. The network organization can be viewed as an organizational answer to tackling the increase in knowledge. The need for utilization of the knowledge is a driving force behind the development (Chisholm 1998). An organizational network is a set of nodes (for example organizations, persons) connected to each other by collaboration. Organizations may choose to pool their resources and work toward some agreed upon goal (Alter & Hage 1993).

Research on general network organization (i. e. network organization without the new technology) offers an understanding of importance for the new situation with network organization based on new technology. Health care organizations planning ICT enabled networks have something to learn from this.

In the early 1990ies the interest for the market mechanism increased considerably in European health care. Not at least so in the UK, with its National Health Service leading the development. Network organization can be considered an alternative to market and hierarchy. Network organization is neither market nor hierarchy. Network organizations can have linkages across formal organizational borders with communication (Ibarra 1992), common tackling of workflow, and common use of some resources. Networking is much about interconnections between individual actors, between organizations, between actors and various technologies (Czarniawska 1997).

Today we find a new use of the term network. We speak about electronic networks (i.e. the telecommunication infrastructure). Inter-organizational relationships did, of course, exist in

health care long before tele-cooperation. In fact inter-organizational collaboration is rather well known in health care. A common example is the cooperation between primary care and hospitals. A minimum of cooperation can be completely necessary for the episode of care to be successful. The technology is the basis for a new form of network organization, i.e. the technology allows closer collaboration between geographically dispersed organizations. Research on general network organization offers an understanding of importance for the new situation. The development is, of course, not so fundamental that, in future, all production lines will have input from telework. Introduction of general network organization in health care cannot build entirely on electronic networks.

A health service which, for other reasons than technology, has chosen network organization has focus on inter-organizational collaboration. The demand for communication channels is increased and this can play an important role for diffusion of technology (Wang et al 2005). The ground for inter-organizational collaboration based on ICT is prepared. The ability to form partnerships is an important success factor for telemedicine (Jennett et al. 2003). Managers and clinicians can view the technology as a new tool for the inter-organizational collaboration. Likewise in a health service with more focus on tele-cooperation the idea of developing a general network organization may more easily emerge: Why don't we organize the whole region as a network, instead of just do networking around the electronic networks? In general, telemedicine can increase the relevance of network organization. The development may challenge existing health care organization.

Definitions

It should be noticed that networks are not only inter-organizational networks. Networks also exist inside organizations (for example in hospitals, a regional health care organization or health care enterprise). All organizations are in important respects social networks (Nohria 1992b). In fact the formal structure of an organization, with a chain of command between levels and units, can be considered a network. Networks can also be entirely informal and horizontal. Communication in any organization, either after the chain of command or not, formal or informal, shows that networks are important in organizations. Even an organization's environment (for example a local community with active patient organizations) can be seen as a part of an organization's network. An organization's contact with the environment, including other organizations, can play a critical role in the shaping of own organizational activities (Nohria 1992b). A number of authors have defined network organizations. The definitions given in the box below are not identical. Several definitions are given to show different aspects of the term network organization.

Network and networking definitions:

Health care definition
A network organization in health care is a group of providers and agencies (for example purchasers) that work together to deliver a broad range of services to their community. The participants can be autonomous organizational units joined together to achieve a common purpose (Alexander et al. 2003).

General definitions
A formal organizational arrangement among a set of organizations that uses the resources of more than one existing organization and specifies the objectives and methods by which

various collaborative functions will be achieved (Gregg & Moscovice 2003).

Networks constitute the basic social form that permits inter-organizational interactions of exchange, concerted action, and joint production. Networks are bounded or unbounded clusters of organizations that, by definition, are non-hierarchical collectives of legally separate units (Alter & Hage 1993).

A network is an interrelated group of businesses with a wide range of ownership structures. Although diverse, these businesses are closely linked together (Alter & Hage 1993).

Networking
Networking is the act of creating and/ or maintaining a cluster of organizations for the purpose of exchanging, acting, or producing among the member organizations (Alter & Hage 1993).

Alliances

Organizations working together may do so to achieve competence complementation, but it is necessary for networks to focus on the very relationships between the organizations. The term alliance is relevant. An alliance refers to any type of relationship between organizations. They may be short or long term, may be more formally contracted agreements or entirely informal (Schilling 2005). Alliances can be used to increase an organization's flexibility. The relationships can be consciously coordinated and planned.

Diagrams of networks

When electronic networks constitute an infrastructure, different organizational networks are possible. Telemedicine can develop from two hospitals, being connected to each other, to a more complex network with many sites collaborating. A well-developed telehealth network can be said to consist of a diverse set of production capabilities connected together and active in performing work. Three characteristics of network organizations have been proposed (Spanjers et al 2001): 1) They consist of at least three nodes. This is, however, in conflict with the following definition 'an organization is a system of consciously coordinated activities or forces of two or more persons' (Barnard 1970). It should also be noticed that two hospitals cooperating by telecommunications is easily understood as a network. 2) Each node can decide independently regarding long-term relationships. 3) The relationships between the nodes must exist for some time, and for more than one transaction.

A well-developed telehealth network consists of a diverse set of production capabilities connected together and active in performing work.

Overview of networks can be obtained by drawing maps, or diagrams, over all nodes and the communication lines.

When organizations are connected into networks the ties between the organizations must have a structure. Overview of networks can be obtained by drawing diagrams (can also be

called sociograms or maps) over all nodes and the communication lines (Brass & Burkhardt 1992; Ford et al. 2004; Sandkuhl & Fuchs-Kittowski 1999). In such diagrams each point is a node and each line is an electronic network. It becomes obvious that networks can be complex with many configurations, or very simple. The position in a network of relationships plays an important role for which actions are performed. Being central in a communication network is a source of power. Central can mean having many relations (Nohria 1992b). If several actors are central lack of stability can be a result. Different actors can have different strategies to obtain benefits (Ford et al 2004). Diagrams of this kind give an overview of all relations in a network, and several diagrams can show all networks in a larger area.

Horizontal organization

In a network organization participants are loosely coupled with weak ties. We do not find they have a superior-subordinate relationship with another. There is no hierarchy, but rather a horizontal relationship (Chisholm 1998). In a true network organization we find more flexibility, decentralized planning and control, and lateral ties (Baker 1992). If a network has a marked hierarchical subdivision of roles and tasks, vertical relationships, and administration separated from production, it can better be called a bureaucracy (Baker 1992).

New developments in diagnosis and treatment, in general, have the potential to move patients away from the hospitals bed departments (Black 2005). This may increase networking. Information and communication technology has given origin to a new term ‘the boundary less hospital’. The boundary less hospital consists of a core facility with acute services, intensive care, and operating theatres. All other units and services are linked by information technology to each other, and the core facility (Braithwaite et al. 1995).

Network organization means a loose coupling of participants. There is no hierarchy with superior-subordinate relationships.

Adaptable networks

The network organization is quite different from the bureaucracy. In a bureaucracy production is done in a system with fixed relationships. A flexible network can mould itself to the task. Tasks, people and resources are adapted to each other in a decentralized way (Baker 1992). With telework collaborating organizations can pool their supplementary skills. Participants can be dependent on resources controlled by cooperating participants. By pooling resources benefits can be mutual (Powell 1990). Networks should not just be considered an alternative way of organizing, but analysis can be performed if it is a more efficient way of organizing (Grimshaw et al. 2005; Rosko & Proenca 2005).

The continuously increasing knowledge in health care raises the question if just updating knowledge on an individual, or single organizational basis, is enough?

Changing organization to network organization can be a contribution.

A network can improve an organization's capability to exploit new forms of knowledge.

Networks can be the basis for shared investment in knowledge and human capital.

Also telework itself can promote learning (Aas 2002; 2005).

With the continuous increase in knowledge in health care, a very important question is how to organize to best exploit the knowledge. Good knowledge is oxygen rich blood for health care organizations. Networks can be the basis for shared investment in human capital (Grimshaw et al. 2005). All organizations do not need to develop all kinds of competence. A network can improve an organization's capability to exploit new forms of knowledge (Grimshaw et al. 2005). Some problems require a combined competence, which can be better obtained by horizontal, or inter-organizational, collaboration. The network can be especially useful for the exchange of know-how, or a particular approach to production (Powell 1990). Networks are suited to deal with complex problems, which are sometimes ill defined (Chisholm 1998). This is not an unknown problem in health care. We can speak about the strength of weak organizational ties.

For the importance of inter-company networks on company performance, of the two perspectives; efficiency strategy and learning through networks strategy, the learning strategy has a greater impact (Hagedoorn & Duysters 2002). Co-operation between companies can help companies to learn different ways of doing things. Then innovative behavior is more likely (Hagedoorn & Duysters 2002). It is highly wanted that health care organizations follow new developments. Collaboration can be an effective part of an organization's learning process (Grimshaw et al. 2005). Health care work is often interdisciplinary work. In interdisciplinary work relationships should include learning about each other's work, knowledge and practices (Haythornthwaite 2005). A benefit of collaboration crossing discipline/ professional boundaries is found in multiple perspectives to provide a broader understanding.

Hospitals taking the advantage of networking, to a moderate or large extent, can be more efficient than hospitals, which do not (Rosko & Proenca 2005).

It should be noticed that we have different kinds of efficiencies. Efficiency is not just about producing at lowest costs in a short time perspective. A different type of efficiency is associated with quality, flexibility, innovativeness, and individualization of services (Alter & Hage 1993). The aim with a network organization can be to improve flexibility and problem-solving capacity (Sandkuhl & Fuchs-Kittowski 1999). In fact the network

organization is designed to handle tasks and environments that demand flexibility and adaptability (Baker 1992). Networks are useful when resources are variable and the environment uncertain (Powell 1990). Medical research continuously develops diagnosis and treatment, and this indeed creates a changing environment with great demands to health care organizations. Instead of keeping pace with the development by all organizations renewing knowledge in-house, networks are an alternative.

Humans and organizations in networks

Telework means the formation of human networks around the telecommunication infrastructure. Those involved directly (clinicians, nurses, radiologists etc) work from different organizations and must cooperate with each other. Management involvement in the collaboration is necessary. Managers in different organizations must cooperate. If policy makers have decided to use telemedicine, managers must take the initiative to form all necessary alliances and, for the network organization to last, show their continuous support to the telemedicine work. Higher levels of management can be active in establishing initial contact between organizations.

Managers in different organizations must cooperate.

Social influence occurs in networks and character of social relations play a role for networks.

Trust is important.

Social capital is as important, if not more, than financial and human capital.

Within networks of tele-cooperation social influence is expectable (Hagedorn & Duysters 2002). In the school of social network analysis social relations play a role for networks to work. Psychological contracts between parties are formed (Grimshaw et al. 2005). Trust is important to obtain a good collaboration. Many contacts over a number of years can help companies build inter-organizational trust (Hagedoorn & Duysters 2002). Long-term bonds, which generate trust, can lower transaction costs (Grimshaw et al. 2005). For work in health care human capital plays an important role. Knowledge intensive activities can require combinations of competence, which exist in the minds of people from different organizations. Social capital concerns relationships between actors. Social capital is as important, if not more, than financial and human capital (Nohria 1992b). Network organization is well suited for a highly skilled work force in a complex production. With high social capital know-how can more easily flow from one organization to another. A network organization can promote pooling of knowledge. Such combined knowledge is not equally easily available in single organizations. The combination of competence from different organizations may result in higher quality, and higher speed of production, than when each organization has to develop all necessary competence.

Select the right partners:

A network's success can be dependent on selection of right partners.

University hospitals can be popular partners, but they are not the only alternative.

Alternatively, smaller hospitals can be organized in networks. They can develop and share common competence.

Networks should not just be made as large as technically possible, but rather search for an optimum network size. A lower number of hospitals connected may be more efficient.

The success of collaboration is dependent on partner selection. It is important to add the right kind of organizations to a network, for example companies with a high network status (Hagedoorn & Duysters 2002). Several factors are important for how well organizations are suited to each other for collaboration, like similarity in values and culture, alignment of objectives, complementarity of resources, relative size and strength (Schilling 2005). In international telework just one organization entering can change the network (Grimshaw et al. 2005).

Small firms, especially those with diverse products, have been proposed to be more likely to develop collaborative relationships (Alter & Hage 1993). Likewise, small hospitals (found in rural areas, with a smaller number of organizational units) are more likely to adopt telemedicine. Values, purposes, and ideologies of smaller hospitals are more fitted to tele-health work (Gagnon et al. 2004). When tele-collaboration is planned the idea of having university hospitals in a central role can easily come up. Smaller hospitals can wish to take the advantage of their competence. Larger hospitals, however may view telehealth as a threat to their autonomy (Gagnon et al. 2004), and fear they will just get an increased workload, without full compensation. The alternative is to organize smaller hospitals into networks. Such networks can be networks of competence, which consciously develops diverse competencies and specialties. They can then share developed competence. In general the new technology offers a potential for sharing production.

Network size may be a factor. A lower number of connected firms may be more efficient (Hagedoorn & Duysters 2002). Large networks can be more complicated to manage with more conflicting interests among members, and more complicated communication. When networks increase considerably in size, the more likely it is that organizations with little need will be included. It is well possible that for a concrete network a size optimum exists, and that inclusion of more participants gradually decreases benefit. Network age may play a role. Knowledge about what works, and what does not, can accrue with time. Organizations planning networks can learn from more experienced networks.

Workflow

Episodes of care often involve different organizations. Collaboration is necessary. The basis for the collaboration is the division of labour between participants. The overall task is divided in different subtasks, and different participants perform different subtasks. More complex episodes of care mean a more complex workflow. At this point the nature of the

total work task requires input from several organizations with a more complex sequencing and timing of inputs. The electronic network has the advantage of rapidly bringing people and equipment together. The network organization can be more adaptive in combining work capacity and competence to solve work tasks. Effective collaboration is not dependent on co-location.

The basis for collaboration about episodes of care is the division of labor between participants.

The electronic network has the advantage of rapidly bringing people and equipment together.

The pooled resources of a network can become greater than the sum of resources before networking started.

The pooled resources of a network can become greater than the sum of resources was before networking started. When organizations are connected by an electronic network the existence of the network can stimulate change. A networked hospital can consciously change its specialty/ competence profile to serve others in the network. A network organization with high diversity can look more tempting for participation. The new technology can challenge relationships between health care personnel, which existed on beforehand (Lehoux et al. 2002). Especially so when the telework potential is realized without listening to employees' wishes about relationships. In fact information about local conditions should always be included in an analysis for realization of potential. For the formation of new relationships management should involve in relationship building. When networks are teams, the teams can be heterogeneous in competence composition, but homogenous in the meaning that each team can serve the same types of clients (Ovretveit 1997).

Managers and governance structures

Management of change is important for adoption of new technology (Gagnon et al. 2004). Organizations planning network collaboration can have different agendas and goals. Formation of networks can mean forming broad coalitions. At this point development of shared understanding, vision, purpose, and goal is important. In such situations management must be involved. Managers should exert their power actively to promote necessary changes (Gagnon et al. 2004).

The change process can be a balancing act requiring tact towards differing interests (Gregg & Moscovice 2003).

In the management of networks there is a need for skills in strategic planning, communication, conflict resolution, coalition building, and identification of activities with benefits for all participants (Gregg & Moscovice 2003). The ICT strategy should then be aligned with clear hospital strategies (Spanjers et al. 2001). Important obstacles to more

telecooperation are found in organizational structures and lack of willingness to adapt to a new situation (Sandkuhl & Fuchs-Kittowski 1999). Physicians' acceptance of e-health is a major challenge for the sustainability of the networks. Physician involvement in decision-making does not necessarily lead to more adoption of e-health (Gagnon et al. 2004). Individual hospitals with an aggressive management, used to obtaining its will locally, can get into conflicts with the other partners (Weil 2000), or end up becoming an influential network partner. Such obstacles do not make management of change less important.

It has been proposed that when employees at lower levels cooperate externally, the role of middle management is reduced, and hierarchies can become flatter (Nohria & Eccles 1992; Sandkuhl & Fuchs-Kittowski 1999). Work is more decided in the interaction between participants. The technology also offers possibility for more control of work processes. This means that span of control can be increased (Nohria & Eccles 1992). Workers at operative level get an extended role, and top-management decides objectives and strategy. In this situation managers' authority is less prominent. Relationships across organizations can in part replace relationships in own organization, and more is decided by cross organization communication.

The existence of a governance structure does not guarantee organizational momentum to take advantage of new technology. Inclusion of patient and population interests in governance structures may be important.

Governance does not mean the same as management. Governance implies setting and monitoring organizational goals, development of strategies through a board of trustees, or directors, to which top managers report (Alexander et al. 2003). In health care the standard for evaluation of strategies and goals can be a benefit to patients and community. The existence of a governance structure does not guarantee organizational momentum (Gregg & Moscovice 2003). Also, not momentum to take advantage of new technology. For boards of health care organizations to act as agents for the community, inclusion of patient and population interests may be important. Patient interests can be taken care of by representatives from patient organizations, and community interests by political representation. Smaller hospitals may wish to join network boards. Representation in governance structures can help in defending local interests and influence general policy formulation (Weil 2000).

Face-to-face contact

The fact that virtual communication can replace face-to-face contact entirely is nothing but a hypothesis that research cannot confirm. Virtual communication cannot replace face-to-face communication entirely (see chapter 2 and Aas 2001; 2005; Nohria & Eccles 1992). A minimum of face-to-face contact is necessary. In a virtual collaboration several things are lacking or being reduced: touch, attraction, discomfort, smell, body language, the possibility for simultaneous feedback which can result in changed communication, and effects of a charismatic personality. Effective network organization requires the multidimensional relationships that can be developed only through face-to-face interaction (Nohria & Eccles 1992). When humans interact the contact may have effect on the motivation for future contact and shape their strategy for a future interaction (Nohria & Eccles 1992).

A network organization should not rely on virtual contact only. Rather, relationships should be started up and formed on the basis of direct contact. Work occurring by tele-communications can then be embedded in relationships shaped by the direct physical contact. The viability of virtual communication will depend on the social relationships created by face-to-face interaction (Nohria & Eccles 1992). If a person has had only virtual contact with another person, a face-to-face meeting can change the mental image built up during virtual meetings.

Why networks?

Why should organizations in health care cooperate? The explanation can be found in very basic health care issues: quality, coverage of patient needs, and costs. Incentives for participation are found in quality requirements (for example improved quality of interpretations in radiology by second opinion), the wish for better satisfying patient needs, like access to specialist care in rural areas), and the potential for meeting organizational needs for cost reduction (for example better being able to tackle increased workload by distributing work on participating organizations). Organizational self-interest is an obvious motivator for network participation (Gregg & Moscovice 2003). For individual organizations considering joining a network some questions are central: 1) What can the organization achieve by joining the network? 2) By joining the network all wishes cannot be fulfilled, but which compromises with the other organizations are acceptable? 3) Are other solutions, than joining a network, better to achieve goals?

Motives for engaging in network collaboration can be both organizational needs and patient needs.

What can electronic mediated work do? Virtual communication can for example increase velocity; amount and range of information flow in a network organization. In a virtual communication participants can also communicate more equally (Nohria & Eccles 1992). Totally we find many different motives for networks, like: economies of scale, reduced duplication of services, improved communication and coordination, greater production capacity and development of new services, enhanced human capital and social capital, joint education programmes, sharing of some administrative functions, sharing of expensive equipment, common buying of materials gives lower prices, more standardized patient treatment for similar patients, joint projects for new developments, and research cooperation.

Costs and benefits

There is no doubt that networks are associated with certain costs and benefits. It can be wise to try to get an overview of the possible gains for the total network. An economic incentive is present when benefits more than cover the costs. By forming networks organizations can share costs and benefits (Alter & Hage 1993). The question then comes up in which way costs and benefits should be shared. For individual organizations participation in a network is advantageous when benefits exceed costs, but analysis based on individual actors' interests only can create sub-optimal solutions for the total network (Ford et al. 2004; Weitzel et al. 2002). Individual organizational participants, and those

with responsibility for a total network, can have different economic incentives for their actions. When much is decided by individual organizations inefficient total networks can result. For management in larger health regions, with responsibility for telemedicine, the challenge will be to find solutions acceptable for different organizations. Search for solutions where all have something to gain is a natural answer. This may mean a redistribution of incomes, costs, and gains for involved organizations. We know little about which characteristics of networks gives which results (Ibarra 1992). It can be difficult to predict which network pattern results in the highest return for an organization (Hagedoorn & Duysters 2002). Organizations that will be worse off with changed organization may work against regional management.

An incentive exists for the formation of a network when benefits minus costs are positive.

Individual organizations, and those responsible for the total network of an area, can have conflicting interests about which network is the right one.

Important benefits can be difficult to measure, and for network organizations this can be a problem (Grimshaw et al. 2005). Benefits can be opportunity to learn and adapt, gain of resources (e.g. time, information), sharing of costs for new developments and project work. Costs can be associated with measures of coordination. Transaction costs are about the costs of exchange, i.e. the costs of information exchange and costs related to contracts (Alter & Hage 1993). Networks have the potential to reduce transaction costs (Powell 1990).

SUMMARY

Introduction

Network organization is nothing new and something connected to new technology only. The network organization can be viewed as an organizational answer to tackling the increase in knowledge. Today we speak about electronic networks (i.e. the telecommunication infrastructure). Telemedicine can increase the relevance of network organization.

Definitions

A network organization in health care is a group of providers and agencies (for example purchasers) that work together to deliver a broad range of services to their community. The participants can be autonomous organizational units joined together to achieve a common purpose. Overview of networks can be obtained by drawing diagrams over all nodes and the communication lines. In a network organization participants are loosely coupled with weak ties.

Adaptable networks

A flexible network can mould itself to the task. With telework collaborating organizations can pool their supplementary skills. The continuously increasing knowledge in health care raises the question if just updating of knowledge on an individual, or single organization,

basis is enough? Hospitals taking the advantage of networking, to a moderate or large extent, can be more efficient than hospitals, which do not.

Humans and organizations in networks

Telework means the formation of human networks around the telecommunication infrastructure. Managers in different organizations must cooperate. Trust is important. Social capital is as important, if not more, than financial and human capital. Network organization is well suited for a highly skilled work force in a complex production. A networks success can be dependent on selection of the right partners. University hospitals may be popular partners. An alternative is to organize smaller hospitals in networks. Search for an optimum network size should be done.

Workflow

The basis for collaboration about an episode of care is the division of labour between participants. The network organization can be more adaptive in combining work capacity and competence to solve work tasks. The electronic network has the advantage of rapidly bringing people and equipment together. A networked hospital can consciously change its specialty/ competence profile to serve others in the network. A network organization with high diversity can look more tempting for participation.

Managers and governance structures

Formation of networks can mean forming broad coalitions. The change process can be a balancing act requiring tact towards differing interests. The existence of a governance structure does not guarantee organizational momentum to take advantage of new technology. Inclusion of patient and population interests in governance structures may be important.

Face-to-face contact

That virtual communication can replace face-to-face contact entirely is nothing but a hypothesis that research cannot confirm. When humans interact the contact may have effect on the motivation for future contact and shape their strategy for a future interaction.

Why networks?

Motives for engaging in network collaboration can be both organizational needs and patient needs. Totally we find many different motives, like: economies of scale, reduced duplication of services, improved communication and coordination, greater production capacity and development of new services, enhanced human capital and social capital.

Costs and benefits

When benefits minus costs are positive for a network an incentive exists for its formation. Individual organizations, and those responsible for the total network of an area, can have conflicting interests about which network is the right one. Important benefits can be difficult to measure.

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Chapter 5: The Virtual Organization

Telemedicine means having a virtual organization. Research has been done on the virtual organization for other sectors than health care. Health care has something to learn from this research, for example concerning management of virtual work and the emphasis on relationships.

Introduction

In the years before the change to the new century commercial virtual organizations were increasing much in numbers. The virtual organization received considerable interest, both in public media and in research. Many of the virtual organizations were operating via the Internet. Then the burst of the 'dotcom' bubble came in 2000 and 2001. The virtual organization was viewed with more sceptical eyes. The burst of the 'dotcom' bubble should not have come surprising. There were many 'dotcoms' which hardly had incomes. But some Internet companies survived and are still operating. An example is the Internet bookstore Amazon. The burst of the 'dotcom' bubble does not necessarily show that virtual organizations are without future.

There is no doubt that virtual organizations are especial organizations. The virtual organization is made to appear by software and hardware. The word virtual is of Latin origin and means thought or potential, but not in fact. Virtual organizations are 'almost organizations' (Snow et al. 1999). The virtual organization may be viewed more as a process or a meta-organization (Bauer 2003). In the virtual organization there is a separation of people, tasks, information, ideas, decisions, talent, and work processes (Ashkensas et al. 1995). Virtual organizations are multi-site, multi-organizational, and dynamic (Snow et al 1999).

Telemedicine is virtual work.
When personnel from different organizations communicate telemedically they form virtual organizations or virtual teams (Cascio 1999).

Virtual organization, definition:
'Members work across space, time, and organizational boundaries' (Lipnack & Stamps 1997).

Virtual team, definition:
'Geographically and/ or organizationally dispersed co-workers that are assembled using combination of telecommunications and information technologies to accomplish an organizational task' (Townsend et al. 1998).

Telemedicine means having a telemedicine virtual organization. It is not right to conclude that when telemedicine is practiced, only now and then, we do not have a virtual

organization. The telemedicine virtual organization makes it possible to work across distance. Some have talked about 'the death of distance', but the virtual organization will not be that widely used. The telemedicine virtual organization operates across distance, for some applications of the technology across time (asynchronous work), and often across organizational boundaries. Telemedicine means not only having a virtual organization, but the organization can also be defined as a virtual team (see chapter two for general definition of a team). Virtual teams can also work both across organizational borders, distance, and sometimes temporal borders. People involved in telemedicine can constitute a small group (Snow et al. 1999) and have only two people involved. This is not in conflict with being defined as an organization. An organization can consist of only two, or more, persons (Barnard 1970). It becomes obvious that telemedicine means performing work by a virtual organization or a virtual team. This applies to different applications of the technology, like telehomecare, teledialysis, remote consultations, teleradiology etc.

The virtual organization

What organizations work with gives organizations character. Tasks and organizational traits are connected. A clear example is found in hospitals where different types of tasks are performed by different departments. What a hospital does can be read from the departments it has. In the traditional hierarchic organization different departments and levels are connected together with a chain of command. The CEO is at the top and we find managers at each hierarchic level.

The virtual organization is different from the ordinary organization.

A telemedicine virtual organization can be operative without a formal organizational hierarchy and chain of command.

The virtual organization is more a horizontal than a vertical organization (Snow et al. 1999; Wiesenfeld et al. 1999).

For virtual organizations understanding the dynamic nature of relationships is more important than designing organizational structure to tasks.

The virtual organization is in fact fundamentally different from the traditional organization. For the virtual organization willingness to perform telework, competence to solve tasks, and job-based flexibility is more important (Sparrow & Daniels 1999). In a health service, planning greater volumes of telemedicine, we have the question of which employees, with which competence, from which organizations, should be bundled together to solve tasks with which characteristics. Virtual work must then be aligned with the general organizational strategy and organizational goals. Even more: implementing virtual organizations can mean touching fundamental aspects of the existing organization. Examples: regional centralization and decentralization changes with management involvement in organizational change processes (chapter 3), mergers of organizations can be relevant (see chapter 2), and a department working both virtually and traditionally may have to adapt its internal organization (chapter 6).

A risk exists for virtual workers to be viewed as an alien body and get in conflict with surrounding organization.

Telemedicine should be included in general plans.

Information systems should be built up for the virtual work and activity reported.

Virtual activity should be included in budgets.

Economies of scale have been little explored for virtual work.

Inclusion of telemedicine in organizations general plans can be viewed as a tool to avoid conflict with hosting organizations. For remote consultations for example, it is advantageous to agree with collaborating organizations when the remote consultations should take place for the coming half-year, plan for changes in selection of network partners, and plan build up of competence for inter-organizational competence complementation. Health care organizations often have reporting systems for their activity. The information systems have a role to play, giving basic data for planning. Information systems should also be built up for the virtual work and activity reported to top management and policy makers. Budgets are economic plans, and budgeting is just as necessary for virtual activity as ordinary activity. Not at least so when virtual organizations are much used. Virtual organizations must be financed. It is not a matter of course that virtual work pays. The cost of separation in virtual teams has been proposed as so huge that their existence is threatened (Melymuka 1997). There is no doubt that virtual work requires extra measures to be taken (see for example chapter 2). Economies of scale considerations may well have a role to play for virtual work, but have been little explored. Maximum efficiency and productivity is achieved only when a certain level of participation is achieved (Wiesenfeld et al. 1999).

A telemedicine virtual organization is classifiable as a type of network organization (see chapter 4). The actors in a network can be individuals, groups, departments, hospitals, or collections of health care organizations. Each node in the network is cooperating with at least one other node. Network studies can focus on the role of nodal units within networks, for example the number of ties, formal role, power in practise over others in the network, social capital, differences in competence, and trust (DeSanctis et al. 1999; Ibarra & Andrews 1993; Powell 1990; Uzzi 1997). The contents of the inter-organizational contact can of course vary according to which application of telemedicine is used. Just as the extent of inter-organizational contact can vary (it can be high or low). The alliances which are formed require some joint processes between participants. Strategy, planning, goal setting, and information sharing are important for lateral structures because these mechanisms align cooperating parties (Mohrman 1999). In addition management should involve in developing skills in networking, and see to that the network has the right combination of professional knowledge. Organizations can be motivated for networking by a wish for input of specialized competence from other organizations, a wish for focusing on own core competencies and solve the rest of the work by partners in the network (or by outsourcing) (Snow et al. 1999). Obtaining a well functioning telemedicine network

organization is not necessarily easy. It can be difficult to build and sustain networks of actors that can organize telemedicine services in parallel to ordinary health care (May et al. 2003).

Virtual work implies collaboration. How this collaboration is done is fundamental (see chapter 2 for a more extensive treatment of collaboration). For virtual organizations understanding the dynamic nature of relationships is more important than designing organizational structure to tasks. Virtual organizations require a relational view (DeSanctis et al. 1999). International telemedicine has been proposed by many, but cooperation across cultural borders may result in substantial misunderstandings preventing work (Mohrman 1999). In international telemedicine we are dealing with work across cultures, legislations, and organizations. This can be quite a demanding situation.

The virtual team

Internationally we find many studies of teams, and teams in general have been studied for more than half a century. Virtual teams, however, have not been extensively studied, and what makes virtual teams effective is not fully understood (Staples & Cameron 2005).

Virtual teams have not been extensively studied, and we lack information about what makes virtual teams effective.

Virtual teams can be without detailed regulations.

A clear purpose is important for virtual teams.

Self-managing work groups may work well. They may have responsibility for: quality of work, setting goals, problem solution, and conflict management.

Virtual teams perform work in a way, which represents a restructuring of the production process. Virtual teams can be without hierarchy, work can occur outside of the host organization's chain of command, and without detailed regulations. Patterns of authority are different from those of ordinary co-located teams (Cascio 1999), and differences in status between participants can be small (Saunders 2000). In such a situation a clear purpose becomes important (Saunders 2000). A low management input is not with logical necessity negative. There are studies showing positive experiences with self- managing work groups (Cascio 1999). An empowered self-managing team may have responsibility for: quality of work, setting goals, problem solution, and conflict management (Sparrow & Daniels 1999). Work with patients often requires different competencies. Teams are well adapted to solve such work tasks. The combination of skills must be functional. This includes not only professional skills, but also skills in communication and collaboration. Likewise roles must be clear to obtain efficient work and avoid conflicts. In a virtual team interdependencies exist between team members (Cascio 1999). A telemedicine team is collectively accountable for delivering a product or service (Mohrman 1999), but not necessarily with a collective legal responsibility. The degree of virtualness may vary for teams. This means variation in how much of the work is virtual work. For example some teams have one virtual session per week, but rarely meet face-to-face. Virtual teams have advantages, like: teams can be formed without co-location, travel time and expenses are

saved, access to remote experts is made possible, team composition is more flexible and adaptable to tasks (Cascio 1999).

Task characteristics are important for motivation.

For the telemedicine virtual team tasks should be motivating enough, i.e. in health care tasks are often important for other peoples' lives.

For the involved mutual expectations should be developed about the nature of tasks and what it means to solve the tasks.

Focus should be given to the needs of team-mates and not primarily focus on satisfying a supervisor.

Which tasks teams perform are not indifferent, but task characteristics are important for team members' motivation (Staples & Cameron 2005). For example, tasks should be designed so that different skills are required by a team, they should constitute a whole and identifiable piece of work, and tasks should be understood to have a significant impact on lives of other people (Staples & Cameron 2005). To be successful, knowledge work teams may be dependent on: clarity and authority, development of mutual expectations about the nature of tasks and how to work effectively together, and focus on needs of team-mates and not primarily focus on satisfying a supervisor (Mohrman 1999). Team size is of importance. Too small teams will not have the resources necessary to effectively perform tasks. Larger teams can give better team performance, but too big teams require much coordination (Staples & Cameron 2005).

Virtual work, identity, and trust

An individual's identity consists of a more personal identity and several social identities. A part of the social identity is taken from the role in working life. An individual's organizational identity is an important source of social identity (Wiesenfeld et al. 1999). With virtual work employees will have more than one organizational membership (the virtual and the ordinary organization), and work with employees from organizations with different cultures.

Virtual workers may feel being in a situation with conflicting loyalties, i.e. loyalty to own organization and the virtual organization.

When people in virtual work are under influence from two organizations the manager's control is reduced.

Managers can, as leaders of organizations, feel a strong personal link to the organizations they lead. Less control can be interpreted as a threat by a manager.

In remote consultations, for example we may have a master-apprentice relationship that plays a role for socialization, shared values (Sparrow & Daniels 1999), and learning (Aas 2002). With much virtual work it becomes important that the involved have the same values, norms and expectations for communication (Sparrow & Daniels 1999; Staples & Cameron 2005).

Managers are as leaders of organizations likely to be more strongly personally linked to the organizations. Due to the responsibility, a manager may wish to have a situation of control. When people in virtual work are under influence from other organizations the manager's feeling of control may be reduced. Less control may reduce a manager's positive self-esteem. The manager can interpret this as a threat. Response to threat can be stress, anger, depression, withdrawal, rigidity of attitudes and behaviour, and fighting back. The behaviour may then become harmful to employees' motivation and even harmful to managers themselves (Wiesenfeld et al. 1999). This can be negative for the future of virtual work. The feeling of threat can also be to the advantage of keeping hierarchies.

Trust can be a problem between participants in electronic work (DeSanctis et al. 1999). Trust is important for virtual teams, even more so than for ordinary teams (Saunders 2000). If managers trust subordinates they may keep a sense of control, but trust is built up over time. Trust cannot be expected when employees are new (Wiesenfeld et al. 1999). Good leadership is important for the development of trust (Misiolek & Heckman 2005). Managers can involve in team building for virtual work with focus on promoting open communication and trust between team members. If managers work virtually themselves, their understanding of the situation can be less in conflict with that of the employees. Managers may then stress traditional forms of control less, because of own experience.

Managers and their role

In ordinary organizations the manager and those to be managed are found on the same site, but in the virtual organization this is more complicated.

Virtual organizations in health care can have a manager on each side of the network, the collaborating sites can have one common manager for the virtual organization, management can rotate, or the virtual organization can be without manager.

The way in which management is performed cannot be the same in ordinary and virtual organizations.

For virtual work managers must have competence in collaboration. Communication skills become more important. Managers in different organizations must communicate.

For virtual organizations mangers can have responsibility for result with less influence.

When the volume of telemedicine is low high management involvement would imply too high costs. Virtual workers can to a larger degree manage themselves.

In virtual work managers must take care of an inter-organizational collaborative network. The direct human contact may be lacking, and for example 'management by walking

around' impossible. The managers' question then becomes: 'How can I manage them if I can't see them?'(Cascio 1999).

Some managers may be very skilled in managing ordinary organizations, but even these managers will have to learn the difference between managing virtual organizations and ordinary organizations. For virtual work managers must have competence in collaboration (see chapter 2) and collaborate both within and across organizational borders (Snow et al. 1999). For the management of virtual organizations skill and professionalism is considered important (Warner & Witzel 2004). Managers must be able to focus on two different ways of managing at the same time, i.e. management of own hierarchic organization and the telemedicine work. Management can be designed to share overall responsibility. This may include team members having their share of responsibility for outcome (Staples & Cameron 2005). Successful virtual teams can have rotating leadership, but not necessarily so (Saunders 2000).

Management of virtual organizations can be a complex task, but it is not that different from managing traditional organizations that no similarity exists (Warner & Witzel 2004). There are several similarities between management of virtual organizations and ordinary management. Traditional management tasks like planning, organizing, staffing, co-ordinating, reporting, and budgeting (Warner & Witzel 2004) do not disappear, but may be somewhat changed. For organizations it is important to have a clarity in who can decide what and who is responsible for what. Managers have authority to decide and responsibility following the decisions. In virtual organizations however, they may end up with responsibility with less influence over decisive processes. In virtual work it can be right to have the decision-making authority close to those working virtually (Aas 1997). Managers will have multiple relationships, both internal and external, and relate to a conflict of interests. They can negotiate a way to go, which includes seeing to that there is support for the virtual work in the different organizations (Cascio 1999).

In practise it is likely that personnel working virtually will manage themselves, more or less. Not at least so when the volume of telemedicine is low. High management involvement in daily telemedicine work would imply too high costs. This means change in the responsibility of middle management. Middle managers will focus less on detailed management of tasks, control of production, and the virtual workers. In other words their job becomes more like that of a higher-level management. Middle managers need to work from a broad overview of the total organization's interests. They can focus on strategy, decide goals, promote achievement of goals, assess if goals are reached, coordinate the virtual organization by measures of collaboration, and integrate virtual activity with ordinary activity. Looking at these points show that managers of inter-organizational virtual work must communicate more, and communication skills become more important. Managers in different organizations must communicate. Decisions cannot be taken just on the basis of criteria related to own organization.

Management of human resources

In the international telemedicine community it is well known that when implementation projects are over telemedicine is not always continued to become routine activity (May et al. 2003). It is also a risk of telemedicine to disappear if telemedicine has been taken care of by a champion for some years, and the champion leaves for work in another organization. In future telemedicine cannot be expected to be the task of champions, but will be done by ordinary employees. Focusing on telemedicine collaboration means less

focus on own organization. The involved may fear this to have consequences for relationships to own organization.

In the telemedicine virtual organization managers should focus more on management of human resources. Not at least giving human support to the telemedicine workers.

Managers' human qualifications become more important, and the need for understanding human resource management.

When employees must have own initiative and higher motivation the question is: how to achieve this? Managers should focus on factors like motivation of employees, protection of virtual workers from being criticized for lower participation in ordinary work, and general human support. When staffing of virtual organizations is considered managers can motivate those planned to be involved, or choose those who are motivated.

Managing with success

It has been proposed that leadership is a major factor for virtual team success, but relatively little research on the nature of leadership for the virtual situation has been performed (Misiolek & Heckman 2005). In the telemedicine community the opinion that management involvement has a role to play is often heard.

It should be noticed that when supervisors of virtual work themselves work virtually this can play a positive role for ordinary participants, for example for the degree to which they are satisfied, productive, and feel trusted (Wiesenfeld et al. 1999).

In fact the manager's behaviour and attitudes may be an important explanation of differences in success and growth of virtual work (Cascio 1999). Managers who are successful in managing virtual work seem to have some characteristics. They trust that employees can perform work with limited direct supervision, communicate well, and are able to delegate (Cascio 1999). Successful management can practise result-oriented management with focus on outcomes (rather than on for example absenteeism). Performance can be encouraged and employees rewarded (Cascio 1999). For virtual teams managers should select personnel with strong interpersonal skills, who can work independently, and have good work ethics (Schilling 2005).

Old ways of managing, for example by supervising work processes, can be evaluated positively by subordinates in the ordinary organization. Practised in the virtual organization employees may react negatively to the same type of management. If virtual organizations require less need for middle managers (self-organizing employees may be more productive) a negative attitude from management may result. Resistance by middle managers may be an obstacle to the expansion of virtual work (Cascio 1999).

The employee

The virtual organization makes it important to reconsider how to take the advantage of human potential (Sparrow & Daniels 1999). Telemedicine virtual work may occur only now and then. This means fewer opportunities to socialize employees to the virtual organization. A fit between individual values and culture is important. A close fit between personal values and organizational culture mean greater job satisfaction and commitment (Sparrow & Daniels 1999). Participants from different organizations can discuss how to tackle the situation of diversity. This can work as training in diversity (Saunders 2000).

The feeling of being connected to the virtual team should be promoted. For this messages of social nature to team members may help (Staples & Cameron 2005).

Participants in virtual work can be informed about characteristics of the programme, in which they work in (Saunders 2000).

Individuals with high preference for autonomy in work may keep back from virtual collaboration. Fear of appearing incompetent can result in not wanting to share work until it has been perfected (Mohrman 1999).

Management has an obligation to information. With a high turnover among team members more time will be spent on teaching new members. Great stability of work force can play a positive role (Staples & Cameron 2005).

In virtual work we find interdependence between actors. Interdependence is about how people depend on one another for mutual support and resources, or about being influenced or controlled by some other entity (DeSanctis et al. 1999). Personnel can become more accepting of interdependence over time (DeSanctis et al. 1999). Not all employees are suitable for remote work. The successful remote employee has been proposed to have characteristics like: not new in the job, self-motivated, communicates well, knowledgeable about organizational procedures, and results oriented (Cascio 1999). Likewise conscientious employees are more motivated than less conscientious when they are not supervised directly (Sparrow & Daniels 1999). How participants view each other can have effect on motivation. A person viewing other participants to have poorer skills can be less motivated (Staples & Cameron 2005).

Health care organizations can use virtual organizations to develop own competence. Virtual organizations can bring together individuals with different competence profiles. Health care organizations will not need to formally employ all people with the competence they need. Virtual work can play a role for continuous learning. Continuous learning can be important for quality improvement. Strong leaders and organizational cultures can also be important for quality improvement through continuous learning (Page 2003).

SUMMARY

Introduction

The word virtual is of latin origin and means thought or potential, but not in fact. Virtual organizations are 'almost organizations'. The burst of the 'dotcom' bubble in 2000 and 2001 does not with necessity show that virtual organizations are without future. Telemedicine is virtual work. It is not right to conclude that when telemedicine is practiced, only now and then, we do not have a virtual organization.

The virtual organization

A telemedicine virtual organization can be operative without a formal organizational hierarchy and chain of command. The virtual organization is more a horizontal than a vertical organization. For virtual organizations understanding the dynamic nature of relationships is more important than designing organizational structure to tasks. In a health service, planning greater volumes of telemedicine, we have the question of which employees, with which competence, from which organizations, should be bundled together to solve tasks with which characteristics. Virtual work also needs to be aligned with the general organizational strategy and organizational goals. Economies of scale have been little explored for virtual work.

The virtual team

Virtual teams have not been extensively studied, and what makes virtual teams effective is not fully understood. A clear purpose is important for virtual teams, work can occur outside of the host organization's chain of command, and without detailed regulations. Patterns of authority are different from those of ordinary co-located teams. In such a situation a clear purpose becomes important. Task characteristics are important for motivation. For the telemedicine, virtual team tasks should be motivating enough, i.e. in health care tasks are often important for other peoples' lives.

Virtual work, identity, and trust

An individual's organizational identity is an important source of social identity. With virtual work employees will have more than one organizational membership (the virtual and the ordinary organization), and work with employees from organizations with different cultures. Virtual workers may feel being in a situation with conflicting loyalties. When people in virtual work are under the influence of two organizations the manager's control is reduced. Managers can, as leaders of organizations, feel a strong personal link to the organizations they lead. Less control can be interpreted as a threat by a manager. Trust can be a problem between participants in electronic work. Trust is important for virtual teams, even more so than for ordinary teams. Good leadership is important for the development of trust.

Managers and their role

Virtual organizations in health care can have a manager on each side of the network, the collaborating sites can have one common manager for the virtual organization, management can rotate, or the virtual organization can be without manager. The way in which management is performed cannot be the same in ordinary and virtual organizations. For virtual work managers must have competence in collaboration. Communication skills become more important. When the volume of telemedicine is low high management involvement would imply too high costs. Virtual workers can to a larger degree manage themselves.

Management of human resources

In the international telemedicine community it is well known that when implementation projects are over telemedicine is not always continued to become a routine activity. In the telemedicine virtual organization managers should focus more on management of human resources. Giving human support to the telemedicine workers is especially important. Managers' human qualifications become more important. Managers should focus on factors like motivation of employees, protection of virtual workers from being criticized for lower participation in ordinary work, and general human support.

Managing with success

The manager's behaviour and attitudes may be an important explanation of differences in success and growth of virtual work. Managers who are successful in managing virtual work seem to have some characteristics. They trust that employees can perform work with limited direct supervision, communicate well, and are able to delegate. One should notice that when supervisors of virtual work themselves work virtually this can play a positive role for ordinary participants.

The employee

The feeling of being connected to the virtual team should be promoted. For this, messages of social nature to team members may help. Participants in virtual work can be informed about characteristics of the programme, which they work in. Individuals with high preference for autonomy in work may keep back from virtual collaboration. Fear of appearing incompetent can result in not wanting to share work until it has been perfected. The successful remote employee has been proposed to have characteristics like: not new in the job, self-motivated, communicates well, knowledgeable about organizational procedures, and result oriented.

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Chapter 6: New technology and internal organizational changes

Internal organizational consequences are very common, but necessary changes can be implemented together with measures of collaboration

Introduction

It is easy to believe policy to be most fundamental for sectors of the society, but for health care it is in fact not self evident that policy interventions are the most influential for organizational change (Henscher et al. 1999):

> Changes in diagnostic and treatment technologies are proposed as the most potent force leading to the substitution of one form of health care service for another.

In the history of health care we find numerous changes in technology. The history of health care is also a history of technology changes. The importance for the production process is fundamental. On a historic basis technology has formed existing work practises. Examples of technology changes are: general anaesthesia, x-rays, antibiotics, psychopharmacologic drugs, and laparoscopic surgery. Present work practises and health care organizations have a relationship to technology development (Karasti et al. 1998). In socio-technical theory organization and technology are viewed together. In socio-technical design work processes are analysed together with organization and technology. The aim can be to improve each and the way in which they operate together.

In the telemedicine community it has frequently been heard that organizational consequences will be the most important. Implementing telemedicine in an organization means having a completely new production process. When organizations involve in external collaboration consequences for the organizations' internal organization may result, but it is not just so that involved organizations are changed by telework. More effective use of the technology may require organizational changes (Southon et al. 1997). It should be noticed that (Eason 2001; May et al. 2003; Sandkuhl & Fuchs-Kittowski 1999):

> The potential of tele-cooperation systems can only be fully realised if their use is accompanied by organizational changes.

A new technology should be incorporated in the organization's operational or managerial work systems (May et al 2003; Zmud & Apple 1992). Organizational readiness is important for telemedicine success (Jennett 2003). Implementing telemedicine is an innovation for an organization. An organization's innovation projects should align with its

resources and objectives, leveraging its core competencies and helping it achieve its strategic intent (Schilling 2005). Research points to the need to understand the nature of necessary adjustments in the organizations (May et al 2003; Zmud & Apple 1992). It can be wise for organizations to prepare for telemedicine by considering their internal organization.

TWO CASES OF INTERNAL ORGANIZATIONAL CHANGES

In the mid 1990ies studies of groups working electronically had to a limited extent examined effects for the participants' own organizations (Shulman 1996), and empirical studies of organizational consequences of telemedicine hardly existed. This has now changed. In the new century we have seen studies giving information about internal organizational changes when telemedicine is used (Aas 2000a; b; 2001a; b; c; d; 2002a; b; 2003a; b; 2005; Aas & Geitung 2005). In a Norwegian study close to all respondents reported of organizational changes (Aas 2001a).

Today we know that internal organizational consequences can be expected when telemedicine is implemented.

In the present chapter internal organizational consequences for two applications of telemedicine are presented, i.e. remote consultations of telemedicine and teleradiology. The two applications are pretty different and represent both synchronous and asynchronous work. Problems with internal organization may then well be different and measures for improving internal organization equally different.

The organizational consequences reported in chapters 2 and 3 are not here defined as internal organizational consequences. Chapters 2 and 3 are focused on collaboration between organizations and organizational changes in geographic areas.

The case of the telemedicine remote consultation

In organizations we find different flows, i.e. flows of information, work material, decision processes etc. (Mintzberg 1994). The new telecommunications have given a new type of meeting between patient and doctor: the remote consultation. In remote consultations we find simultaneous flow of services to the production line from different organizations, which are not co-located. It is not just easy to change work practise. Work practises can be well worked in and clinicians can find it difficult to integrate new modes of practice into deeply embedded existing work processes (May et al. 2003). For teledermatology we find a development in the direction of using still images. Still images (store-and-forward type) represent a major change in the work process, and when used the remote consultation may become unnecessary (Moseng 2000).

Physicians have been encouraged to look positively on teleconsultations (Lehoux et al 2002). In fact remote consultations between GPs and specialists, with patients present, can be feasible and acceptable to all parties involved (Harrison et al. 1996), but doctors' concerns over increased workload may be justified. A first consultation can be used to decide what to do and a second for the telemedicine session. The extra time required is a

drawback (Lehoux et al 2002). Using tele-consultations is not independent of distance. When distances are short physicians prefer patients to travel for a specialist consultation (Lehoux et al 2002). Other perspectives limit the relevance of the teleconsultations too, specialities relying on either thorough physical examinations, or specialised investigative techniques, are less likely to use telemedicine, and complex cases can be considered less suited for telemedicine (Lehoux et al 2002).

The internal organizational consequences presented here are from empirical studies of remote consultations (Aas 2000a; b; 2001a; b; c; d; 2002a; b; 2003a; b; 2005). The telemedicine remote consultations were from four areas: telepsychiatry, teledermatology, telepathology frozen-section service, and teleotolaryngology.

For telemedicine remote consultations several categories of internal organizational effects are treated here: Change in organizational structure, new ways of coordination, staffing changes, co-operation with and change in relationships to others in own organization, consequences for the work of those who do not participate directly, changes in job situation, champions and opponents of the technology, goal formulation, ideal number of remote consultations per week, easily available equipment, learning, and change in work process.

Change in organizational structure

For the relationship between organizational structure and technology research has been done since the 1960s (Roberts & Grabowski 1996). Organizational structure encompasses the general organizational structure itself, division of labour, authority and responsibility, span of control, linkages, and communication networks (Chapman et al 1995). It should be noticed that the structure of an organization can significantly influence the likeliness of taking advantage of new technology (Schilling 2005).

Technology can trigger structural changes in organizations (Orlikowski 1992), but a Norwegian telemedicine study demonstrates an even more direct relationship (Aas 2001a). Telemedicine can be a necessary precondition for change in organizational structure. A new organizational unit is a structural change and in principle an important change.

For a local hospital, without dermatologist employed, telemedicine made it possible to have a more complete dermatology department.

Before telemedicine a dermatologist visited the local hospital at regular intervals, but the patients also travelled to a university hospital with a dermatology department. After the implementation of teledermatology an UV-light treatment unit was added at the local hospital. A new organizational unit and level was then made by appointing a nurse to lead the dermatology department. In future more dermatology may occur locally, with the local level supported by dermatologists at larger hospitals.

With the technology organization can occur around an infrastructure consisting of electronic networks. Then we are dealing with new ways of organizing health care, with new requirements to internal organization and management. If organizations can be formed independent of co-location a new situation for economies of scale comes up. When organizations in different geographic locations are merged the leader can live in one of the locations and have regular contact performed by telematics. Merger of health care organizations means having a new organizational structure. Hospitals with a system of geographically separate satellite clinics, and with a common management, have been proposed. The boundary-less hospital (Braithwaite et al. 1995) opens for increased decentralization of supply, retention of locally recruited personnel can become easier, and patient travels are reduced. For such a development to occur management by telematics must work well. From Norway we have an example of merger of organizations based on new technology (Aas 2001a):

> In psychiatry a new organizational unit was formed by merger of two outpatient clinics. To co-ordinate the manager of one of them was made the manager of both.

New ways of coordination

New technology represents a possibility for new ways of coordination. With telematics administrative meetings can be arranged with participants in studios in different locations, but it is necessary that such meetings work well (Archer 1990; Kiesler & Sproull 1992; Shulman 1996).

> When different parts of organizations are not co-located administrative meetings can be arranged as videoconferences.

Remote consultations require the same time participation by people in different locations. To achieve this coordination is necessary. Technically, appointments for each remote consultation sessions can be made by waiting until enough patients have accumulated for a session. To make appointments for each session is, however, time consuming. Appointments must be made between medical specialist and primary care doctor, and studios must be free in two locations. For the general practitioner it would have been simple if the equipment could just be switched on, but this would require telemedicine specialist clinics with good capacity for remote consultations, and without remote consultations coming in conflict with other tasks. A good alternative is to coordinate by deciding a common schedule for a coming half year (see chapter 2).

For remote consultations same time presence is necessary. Participants in remote consultations can make a common schedule for a coming half year. The common schedule tells when sessions for remote consultations take place, for example each Monday after lunch.

Pathology departments may need internal co-ordination to take care of frozen section telepathology. The simplest can be to allocate responsibility for telepathology to, for example, two of the departments' pathologists. A more encompassing solution is to establish a weekly duty, rotating between the pathologists, to take care of the frozen section telepathology. Such a solution can mean economic compensation for the rotating duty and tie up more resources. At local hospitals the telepathologic frozen section service involves several people from both operating theatres and laboratories. This may necessitate the formalisation of the responsibility of the personnel involved.

Staffing changes

Personnel costs represent a significant part of total costs in health care. Use of IT has been proposed to increase the number of tasks and the types of skill necessary for employees (Kraemer & Danziger 1990).

For remote consultations costs are not reduced by reduced staffing, but new employments are few.

The present volume of remote consultations is limited and we know little about staffing effects of a higher volume. Mainly telemedical work is done by changing job contents. With telemedicine employees have more mixed roles and perform more functions.

In a Norwegian study (Aas 2001a) a psychiatrist's private practice functioned as a satellite office for a psychiatric outpatient clinic. The psychiatrist participated in administration, gave support and guidance to the personnel in clinical matters, and had some remote consultations with patients, but he lived 2000 km south of the hospital. The technology makes employment of psychiatrists, who live far away from the responsible hospital, possible. A local hospital with recruitment problems for psychiatrists can take the advantage of this new flexibility in employment policy. Telepsychiatry may function quite well and give high satisfaction rates (Clarke 1997; Aas & Geitung 1998).

The technology makes employment of personnel, who live far away, possible. This can be relevant when special qualifications are required.

A general principle is that work tasks should be performed by the profession able to perform them at lowest costs without reduced quality. In substitution experiments one profession substitutes another in the work with tasks. To have doctors on both sides of the

electronic network implies high cost. Substitution of the general practitioners by nurses can be considered. Compared to some substitution experiments, outside of telemedicine, the role of the nurse in telemedicine is professionally quite simple. Among telemedicine workers positive attitudes to substitution are quite common (Aas 2001d), but the possibility that nurses use more time should not be overlooked. Substitution of GPs by nurses can also result in less learning for the GPs. There is reason to perform more systematic evaluation of substitution in telemedicine.

When remote consultations are performed, with doctors on both sides of the electronic network, costs are high. Substitution of the general practitioners by nurses can be considered, but few substitution experiments have been performed.

The technology is so easy to use that it does not require much new employment of technicians.

It is not just so that the technology requires new employment of technicians. Many find the technology easy to use, i.e. the need for new employment of technicians is limited (Aas 2000). With teledermatology more treatment can be done locally. When teledermatology makes a new dermatology department possible at a local hospital, employment of a nurse and a secretary may be necessary (Aas 2001a).

Co-operation with and change in relationships to others in own organization

The involved in telemedicine need continued cooperation with people in own organization, but telemedicine means a shift in focus from own organization to collaboration with other organizations. The organizations get employees working more autonomously in relation to own organization. Electronic co-operation may even make participants to a new interest group in the organizations (Fulk 1993; Mynatt et al 1997; Morton 1991).

It is thinkable that telemedical work results in isolation from own organization, but in a Norwegian study (Aas 2001a) half of the respondents could not report of any change at all, i.e. neither more nor less co-operation with others in own organization. When changes were reported they showed increased co-operation with persons in their own organization, and no-one said that they co-operated less with persons in their own organization after having started using telemedicine.

Telemedical work does not result in isolation from own organization, but rather the opposite. Reduced travelling can contribute to more cooperation with people in own organization.

Working with remote consultations affects relationships to persons in own organization little.

In IT-based collaboration social influence may play a role for participants' attitudes (Fulk 1993), and participants have been proposed to become more dependent of each other (Kraemer & Danziger 1990). For the involved in remote consultations relationships to

persons in own organization are little affected. When work with telemedicine plays a role for relations to own organization it most frequently makes those involved know someone better. It is conceivable that leaders will see reduced control when employees work with telemedicine, and that they will respond by implementing systems for control (Kraemer & Danziger 1990). A Norwegian study (Aas 2001a) showed no reason to believe that the relationship to leaders is affected, or that leaders change the mechanisms for control.

Consequences for the work of those who do not participate directly

When some start with a new activity this can have consequences for others work. For telemedicine remote consultations such consequences are very common. Frequently others have to perform tasks in their colleague's absence (while they work with telemedicine). In addition aid personnel have to perform some secretarial work, and the telepathologic frozen section gives double workload (ordinary sections are also made of the same tissue lump).

For telemedicine remote consultations have consequences for the work of those who do not participate directly are common.

The total effects of telemedicine makes it wise to inform the whole organization when it is implemented, and prepare those working close to the new activity.

People who work with telemedicine can share their experiences with others (Aas 2001a). Diffusion of knowledge is important for an organization and constitutes a mechanism for organizational learning (Nikula 1999). When individuals exchange information, attitudes and behaviour can become more alike (Eikebrokk 1997).

Reduced travels for employees can improve work capacity of their organizations, and time on waiting lists may be reduced for the patients.

Changes in job situation

Implementation of technology is not always successful. High failure rates for implementation of IT can be related to several factors, including individual factors (Southon et al. 1997; Eikebrokk 1997). Early in the history of IT implementation work life issues were given less attention in research than technical and economic factors (Aydin 1994). Computing, in general, can have complex and profound effects on jobs (Aydin 1994; Eikebrokk 1997). Research has shown jobs to become more interesting and enjoyable (Karasek & Theorell 1990), and most studies show increased workers' job satisfaction (Aydin 1994; Kraemer & Danziger 1990). But the image is not just bright. Many have experienced health problems related to work with IT (Sørensen 2000).

For teleworking, in general, a number of negative job characteristics have been reported, like poorer physical working conditions and less social support from work (Sparrow & Daniels 1999). Telemedicine sessions require a continuous attention towards the screen. People from different organizations are dependent of each other, and a patient is present. The autonomy in the work situation is reduced. Health effects at the workplace may be dependent on the combination of demand vs control, i.e. high demand combined with little control of the work situation is considered particularly disadvantageous. It may lead to

stress related diseases (Söderfeldt et al. 1997; Karasek & Theorell T. 1990). Several hours in the telemedicine studio can be tiring, and work with telemedicine stressful. In spite of this none in a Norwegian study reported of health problems related to telemedical work (Aas 2002a). The explanation may well be that the volume of telemedicine was too low. For other types of screen work health problems are reported (Sörensen 2000). Stress among employees may be related to the quality of the IT system (Solberg et al. 1998).

Working with remote consultations can be tiring and stressing, but none in a Norwegian study reported of health problems related to telemedical work.

The telemedical activity per employee can be limited to avoid the problems.

In a future, with a larger volume of telemedicine, leaders may have to involve in job design. The problems are solvable, for example by limiting the telemedical activity per employee. It is possible to doubt a vision for the future with large telemedicine clinics, for example in psychiatry and otolaryngology, where many specialists work full time. Such organization, with a large volume of telemedicine per employee, would at least require a planning of the workday with several fixed breaks. An alternative way of organizing is to use large clinics, for example university clinics, where the work can be distributed on many specialists.

The changes in work situation include advantages. Telemedicine workers most frequently mention reduced travelling. Fewer travels give more time for other activity and productivity is improved. Resources are saved as treatment can be given earlier in a history of disease, and hospital admissions become fewer. Other advantages are: not having to travel in bad weather, more confident employees with a more easily available professional support, and it is more satisfying to be able to see partners of communication.

The technology can play a role for co-operation. When the technology makes it possible to participate in daily and weekly meetings new contacts are obtained. In psychiatry arranging meetings with several participants becomes easier. More frequent co-operation and more employees participating in co-operation are definable as a more teamwork. Delivery of health care by teams has been considered positive for quality (Wagner 2000).

The technology makes it possible to obtain more cooperation. More frequent co-operation and more employees participating in co-operation, are definable as having more teamwork. More cross-professional teamwork and increased contact with specialists can be positive for quality.

Telemedicine is not only for the very young. Increasing age can be significantly correlated with decreasing anxiety for telemedicine technology.

Telemedicine is an activity in addition to ordinary work, but how well does telemedicine fit into a situation with much ordinary work? Most respondents in a Norwegian study (Aas

2002a) were of the opinion that telemedicine fitted well into daily work, but for some the answer was conditioned by a planning of dates for sessions some time in advance. The positive answers can be related to the limited volume of telemedicine. The effect of telemedicine on a daily work situation may depend on how the organizations tackle the situation. It should be noticed that telemedicine is not only for the very young. Some years of experience make health personnel feel safer about own skills, for example what image quality it takes to diagnose safely in teledermatology. Increasing age can even be significantly correlated with decreasing anxiety for the use of telemedicine technology (Aas 2000).

Champions and opponents of the technology

It is well known that changes in organizations can have both champions and opponents. Diffusion and use of communication technologies are under influence of social factors (Aas 2000; Eikebrokk 1997; Rogers 2003). For example physicians may influence each other, when it comes to attitudes to technology, but it is not a matter of course that they resist IT. They may also adopt it with enthusiasm (Kaplan 1997). If non-diffusion occurs this may be related to the technology's effect on professional autonomy and doctor-patient relationship (Kaplan 1997).

A Norwegian study showed both champions and opponents of telemedicine (Aas 2001a):

> 67 % of the respondents reported about champions for the new technology in own organization.
>
> Opponents resisting telemedicine seem to be less frequent than champions. Totally 13 % of the respondents reported about opponents resisting the change.

Champions have a role to play for implementation of technology (Aydin et al. 1998; Rogers 2003). If managers are champions it is more likely that telemedicine will succeed. Senior management commitment may be important for successful implementation of IT (Galliers 1994; Rogers 2003). Involvement of personnel is important for change processes. For people to embrace change they must be actively involved in the change process, not merely informed of it (Lorenzi 1999).

Resistance to IT has been proposed to be due to poor technology, lack of knowledge among users, or interactions among technology, users and the organizational context (Kaplan 1997). For telemedicine resistance can be due to heavy workload (for the primary care doctor remote consultations are more resource requiring than referrals) or lack of direct contact in the remote consultation (Aas 2001a). If use of a system is considered an additional burden by medical staff implementation of a technology may fail (Southon et al. 1997). Implementation of telemedicine is not necessarily met with general negativity. In a Norwegian study none of the respondents had a generally negative attitude to telemedical work (Aas 2000). They did not tell about an opposition to telemedicine preventing its implementation, but enthusiasm can reduce over time. It is thinkable that an expanded use of telemedicine will change the image concerning support and opposition to using the technology.

Goal formulation

Formulating goals for an organized activity has been considered important in management theory. In private industry MBO (management by objectives) (Mintzberg 1994) has roots back to the 1950-ies (Lægreid 1991). Also when IT is implemented, and for virtual teams, goal setting may be important (Mohrman 1999; Eason 2001).
Research shows however, that managers in organizations planning telemedicine activity do not need to prepare the personnel by organizing communication on goal formulation, and contents, for the remote consultations (Aas 2003). The explanation may be that the goal for a remote consultation is the same as for an ordinary consultation, i.e. to diagnose and decide treatment. In the remote consultation roles are given by the personnel's educational background. For the single health care worker a remote consultation does not require more preparations than an ordinary consultation.

Ideal number of remote consultations per week

Limits for telemedicine activity:
In teledermatology and teleotolaryngology half a day per week is acceptable for personnel.

In telepsychiatry 1-3 remote consultations per week can be ideal.

When employees work with telemedicine total workload should be adapted.

Personnel involved in remote consultations do not want to have this as a full time activity, but rather time in studio should be limited (Aas 2002a). In teledermatology and teleotolaryngology half a day per week seems to be acceptable. If total workload is adapted it is not impossible that the volume of telemedicine could be increased to a few half days per week. In telepsychiatry 1-3 remote consultations per week is commonly mentioned as ideal, with a maximum of one day per week. Within the telepathologic frozen section service the ideal number of sections per week per employee was from one to four. Few sections may give little experience and this may be a problem (for example for laboratory technicians doing the technical preparation of the sections). Increasing the number of sections to one per day can represent a problem for other tasks.

Easily available equipment

Organizations planning telemedicine remote consultations should make the equipment easily available. The ideal is to have equipment at own office.

Telemedicine equipment should be easily available (Aas 2002a). Organizations planning telemedicine activity should make the equipment easily available. Needing to travel a few kilometres, or a longer walk at own hospital may be too much. For increased use of telemedicine it can be necessary with studios at primary care centres, or mobile equipment

which can be used everywhere. The ideal is to have the equipment at own office. In future, it is fairly likely that live sound and image can be transmitted, with good quality, from any PC.

Learning

In health care learning by dissemination of knowledge is a tool for improving patient care. Working with telemedicine has been proposed to result in learning, and empirical knowledge confirms this (Aas 2005):

> Four of five respondents can tell they learn something new by working with remote consultations.

First of all they improve their knowledge of the specialty in which they are involved, for example personnel involved in telepsychiatry learn psychiatry. All GPs say they learn something new; nurses, psychologists, other categories of personnel, and even medical specialists report that they learn from the use of telemedicine. When all within psychiatry say they learn something new, the future learning potential of telepsychiatry looks promising. When health care organizations connect for telemedicine they also connect for learning. The learning effect in itself may constitute an argument for telemedicine. Even with a limited time used on teleconsultations they are of clear educational value.

Change in work processes

Analysis of work processes can be important for organization of work, and to find the optimum interaction of human and technical resources (Dijck 1984). Telemedicine itself is a change in work process, but there are changes in addition to that. Other change in work processes are common, i.e. 77% of the respondents in a Norwegian study confirmed that telemedicine had given such changes (Aas 2001a). Implementing telemedicine does not mean that telemedicine will be performed after finishing of the implementation project. For a longer term stabilization of telemedicine in organizations new procedures should be accommodated into clinicians' clinical activities (May et al 2003).

> 77 % of the respondents in a Norwegian study confirmed that telemedicine had given changes in work processes.
>
> The network may play a role for decisions concerning medical and nursing standards, criteria for admission and discharge.
>
> When resources are used on external communication it may be right to move management decision making closer to the place of occurrence. Decentralization may become more important with an increasing volume of telemedicine.

An episode of care can involve several levels of care. Co-ordination of the levels of care becomes important (Aas 1999). Telemedicine makes it easier to obtain co-operation with

the local health service after discharge. The network may also play a role for own organization's development in for example decisions concerning medical and nursing standards, criteria for admission and discharge. When resources are used on external communication it may be right to move management decision making closer to the place of occurrence. This can be done by moving tasks downward in the existing organization, or by changing organizational structure to a more decentralised form. Such decentralization (Aas 1997) may become more important with an increasing volume of telemedicine.

Change in work processes can be positive for quality. GPs working with telemedicine can find that other GPs refer patients to them for remote consultations. Patients, in need of specialist treatment, can then receive treatment earlier (Aas 2001a).
Psychiatric patients can receive follow up by telemedicine, after transfer to their local community, and travel for specialist treatment becomes unnecessary. The local ancillary personnel can obtain professional instructions by telematics from a psychiatrist, and this can result in learning. Increased competence for the organization may result in changed work boundaries between doctors and nurses, with the nurses performing tasks previously done by doctors (Gerrard et al. 1999). In general the technology can result in improved contact with mental hospital concerning discharge and admission.

The case of teleradiology

In Norway the radiology sector is in a process of great change. Within a few years all radiology departments in the country's five health regions will have PACS. This has been followed up by building a digitalised telecommunication network with great capacity. Technically sending radiology images in between health organizations will be far easier and faster than before. A new era for radiology has started.

Core functions of radiology are capturing images and interpreting images, but consulting is also a part of the work. Clinicians can consult radiologists and radiologists clinicians. Implementation of PACS means a completely new production process for the radiology departments. Organizational consequences are likely to result. Capturing images and interpretations can be split and occur in organizations found at different locations. When organizations involve in external collaboration this may have consequences for internal organization (Aas 2003b; 2005a;b). It should be noticed that distinguishing between what is the effect of teleradiology and the effect of PACS can be difficult.

For teleradiology the following main categories of internal organizational effects are treated: Change in organizational structure, new ways of coordination, staffing changes, co-operation with and change in relationships to others in own organization, consequences for the work of those who do not participate directly, champions and opponents of the technology, goal formulation, easily available equipment, learning, change in work process, and consequences for the clinico-radiological conferences.

Change in organizational structure

Traditionally hospitals are organized with departments as building blocks in a hierarchic structure. In a hierarchic structure tasks must be distributed between levels and departments. Changes in organizational structure are fundamental changes requiring

changes in how organizations are managed and coordinated. Implementing PACS and teleradiology based on PACS is a significant change in production process.

The question then comes up of consequences for internal organization of radiology departments. Radiology departments may well be too small organizations for major structural changes connected to the new technology. Change in distribution of tasks between levels and units, as a consequence of the new technology, is rare at radiology departments. When changes are done they are not necessarily due to the technology. With its present volume teleradiology is a task done in-between other tasks.

Organizational specialization in performance of work tasks is a well-known measure for quality assurance. Specialization in radiology can be based on organ system, modality (for example MR), and type of radiology examination. Radiology departments can be split in sections. Establishing sections with specialization in work tasks is more relevant at large departments. They can have sections for organ systems and acute radiology (Andersson 1998). Teleradiology may promote increased specialization among radiologists. When many radiology departments are connected the work force of sub-specialists can be more easily exploited.

Radiology departments can be too small organizations for major structural changes connected to the new technology. Internal organizational structure at radiology departments can be simple.

As long as the volume is low teleradiology is a task done in-between other tasks.

For large radiology departments it is thinkable that much teleradiology will lead to formation of teleradiology sections, but having work split on sections is not problem-free.

When IT personnel are recruited to larger radiology departments they may form own groups, but IT work can also be outsourced, or taken care of by the hospital IT-department.

For radiology departments teleradiology can be in conflict with ordinary work tasks and in practise get lower priority. It is thinkable that much teleradiology will lead to formation of teleradiology sections (to ensure teleradiology is protected from having lower priority). The result can be, in periods, poor adaptation between workload and work capacity for the teleradiology section and the rest of the department. With no sectioning, and personnel competent to perform all tasks, more flexibility is obtained. Having a teleradiology section means clarity in who is responsible for teleradiology. Increased volume of teleradiology can trigger sectioning discussions. An alternative is to let private radiology centres take care of teleradiology. When IT personnel are recruited to larger departments they may form own groups, but IT work can also be outsourced.

Organizational merger is well known from the radiology sector in Norway. With organizational merger problems, which previously concerned external relations, become internal organizational problems.

Merger of radiology departments with much teleradiology means having an active virtual organization.

Virtual organizations will often be flat organizations.

If several departments in different locations are merged the resulting organization can become difficult to manage and methods for management must be developed.

When organizations merge problems, which previously concerned external relations, become internal organizational problems. Radiology departments have been used to manage themselves without an encompassing collaboration with each other. Organizational merger is well known from the radiology sector in Norway and seems to ease teleradiology collaboration (see chapter 2). When people at different sites collaborate with telecommunications they form virtual organizations. Merger of radiology departments with much use of teleradiology means having an active virtual organization. For virtual organizations a marked hierarchy, with several levels and with an active chain of command, is less relevant. Virtual organizations easily become flat organizations. If several departments in different locations are merged the resulting organization can become difficult to manage. Methods for management of distantly located departments must be developed. The leader can live in one of the locations and have regular contact performed by telematics. A situation with common knowledge can be developed by common information systems based on e-mail, or a common Internet site. Planning and budgetary processes can be common. Personnel can have common courses and social meetings. They can rotate between collaborating departments and learn to know working conditions at other sites. The different locations should have a common organizational culture. A situation with the same technology and common computer store makes collaboration easier.

New ways of coordination

Examples of new mechanisms of coordination:

Paper forms for waiting patients can be put in a box and moved over to another box when finished.

Cross professional meetings can be organized, with discussion of problems related to the new technology.

The electronic network between workstations can be used for messaging.

A RIS (radiology information system) can be basis for an information system with production statistics. The availability of comparable data can play a role for productivity improvement.

New mechanisms for coordination and management can be motivated by new technology. Examples of new mechanisms can be: a) When images are found in computers only, interpretation can be forgotten in some cases. For patients coming to the department a paper form can be filled in which follows the patient through the department. Paper forms for waiting patients can be put in a box and moved over to another box when finished. An alternative can be to develop computerized reminders telling number and computerized location of images waiting for interpretation.
b) The new technology affects all groups of personnel and they need to communicate. Cross professional meetings can be organized, with discussion of problems related to the new technology. Teaching can also be cross professional. More common knowledge can promote cross professional collaboration. c) With personnel spending much time at workstations messages can easily be distributed. The network can be used for messaging and personnel can read messages on own screen. d) PACS is always implemented together with a RIS (radiology information system). RIS can be basis for an information system with production statistics. Such statistics can give information about the number of examinations of different categories performed by each radiologist and each department. The availability of comparable production data can play a role for productivity improvement.

Staffing changes

Implementation of PACS and teleradiology can result in little change in total employee numbers. This does not mean that workload does not change, but rather more radiology is performed. With old technology increased production would have required more personnel. For some departments workload can increase especially much. These departments spend much time on teleradiology interpretations. The situation is an argument for increased staffing. Some radiology departments are small and have few employees for their workload. When teleradiology comes on top of a heavy workload more personnel is needed. In future re-evaluation of distribution of personnel between radiology departments in regions can be necessary.

Implementation of PACS and teleradiology can result in little change in total number of employees.

A clearly increased workload by teleradiology can be an argument for increased staffing.

Composition of personnel can change at radiology departments.

New technology can lead to a shift in who performs which work task.

In spite of little change in total staffing the composition of personnel can change. The number of assistants and office personnel may reduce. IT-personnel and 'superusers' (often radiographers with additional qualifications in technology and teleradiology) are new categories at radiology departments. If the total number of radiologists changes the change is an increase.

Teleradiology has contributed to a discussion concerning distribution of tasks between radiologists and radiographers (Uldal & Störmer 1998). New technology can lead to a shift in who perform which work tasks. Radiographers have in some cases been given new work tasks, like retrieval of necessary patient data, comparison with previous images to see how an examination was performed, and further preparations of images after capture.

Co-operation with and change in relationships to others in own organization

The cooperation between clinicians and radiologists can change. With the new technology clinicians can look at images, and read the radiologist's interpretation, at monitors in their own department. When needed clinicians and radiologists can communicate on the phone. The technology questions the future of the clinico-radiological conferences. When more radiology is teleradiology it becomes difficult to organize clinico-radiological conferences (see own treatment of issue under heading: Consequences for the clinico-radiological conferences).

Cooperation between clinicians and radiologists change.

When radiologists spend much time at their workstations less collaboration with radiographers may result.

In general the change in composition of personnel, and new tasks for different groups, can change the nature of co-operation and relationships.

When radiologists spend much time at their workstations, the result can be less collaboration with radiographers. Radiographers can also perform tasks at workstations. Then the two professions work more separately than in teams. In general the change in composition of personnel, and new tasks for different groups, can change nature of co-

operation and relationships. When IT-personnel start working for radiology departments, co-operation with a new group must be established.

Consequences for the work of those who do not participate directly in capture and interpretation

When PACS and teleradiology are implemented consequences for the work of those who do not participate directly in capture and interpretation can be expected. None working at radiology departments are unaffected by implementation of PACS. Office personnel and assistants lose work tasks, like retrieval of images from archives, putting images in envelopes, and darkroom work. New tasks can be screen-work with retrieval of images from computer archives, responsibility for patient appointment lists, giving assistance during capture of images, and transmitting images to other hospitals.

All working at radiology departments are affected by the technology change to PACS/ teleradiology.

Clinicians see effects of the new technology. They can view images, and read interpretations, from monitors at own department. When clinicians can view images, and read interpretations, earlier treatment can start earlier. Clinicians can look at images together with distantly located radiologists. When clinicians and radiologists communicate, we are dealing with an important interface for clinical and radiology departments (Mun et al. 2003).

Champions and opponents of the technology

Champions can be charismatic individuals who are agents for change. It does not need to be single individuals who promote new technology, but it may be groups of enthusiasts consisting of a few persons. They can work in a situation with little general acceptance of the change. The success of technology implementation can depend on the existence of champions. Champions can create a positive atmosphere from the start (Rogers 2003; Strömgren 2003; Weinstein et al. 1997). For the early implementation of PACS and teleradiology champions have a role to play, and projects aiming at greater volume teleradiology can benefit from involving champions. Management interest for the new technology is important, and the ideal can be managers who are champions (Galliers 1994; Rogers 2003).

For the early implementation of PACS and teleradiology champions have a role to play, and projects aiming at greater volume teleradiology can benefit from involving champions.

Some hospitals can see resistance to the change. The resistance can reduce with time.

Organizations may well need to change over time, and change with changing technology, but organizations are also in need of stability. Implementing PACS and teleradiology is not possible without organizational change. Some hospitals can see resistance to the change.

Such resistance can reduce with time. The resistance can be due to anxiety of organizational change implications, too low priority from management, low interest and motivation from personnel, lack of involvement of personnel, fear of increased work load, defence of own territory, technology anxiety, lack of resources, and lack of knowledge.

Goal formulation

Formulating goals may be important when IT is implemented (Mohrman 1999; Eason 2001). Goals can be fundamental, like improved quality and better exploitation of resources. Choice of goals can be decisive for changes made. For the diffusion of teleradiology communication on goal formulation seems to have limited importance. Few working with new technology have participated in such communication. Goals mentioned by those working with the new technology can be: to be able to transmit images freely in-between hospitals, that images and information can be retrieved independently of patient location, to exploit total radiology resources in a region, and to improve supply to patients (earlier treatment, improved diagnostics). Managers in hospitals planning teleradiology do not need to organize an encompassing communication about goal formulation. Goals for teleradiology can be rather obvious and easy to understand.

Easily available equipment

Workstations should be easily available in sufficient numbers. This eases distribution of workload, and total work capacity can be better exploited.

It is important that radiology departments have sufficient number of workstations. All radiologists should have one available, and when needed workstations should be available for radiographers. When a department has a larger number of workstations a better workload distribution can be obtained in-between radiologists. Total work capacity can be better exploited. Too few workstations will lower productivity. Workstations should also be available at clinical departments, where clinicians prefer to perform interpretations themselves.

Learning

The new radiology technology undoubtedly has a role to play for learning. Larger and better archives of images can be built up commonly for hospitals in a region. Such archives can be the basis for development of large teaching archives.

Radiologists from smaller hospitals can learn from interpretations performed at university hospitals.

Even small hospitals can organise remote teaching. Totally, more people can have access to resource persons.

Larger and better archives of radiology images can be built up, common for hospitals in a region. Such archives can be the basis for development of large teaching archives. The teaching archives can include for example specialized archives with interesting cases. Quality assurance can be done by supervision. Supervision of daily work at radiology departments becomes easier. Managers of departments can more easily take a look at images and interpretations, and give feedback to the radiologists. Learning may result.

The new technology can result in more communication. Not at least so between hospitals. People from different radiology departments can learn from each other. Radiologists from smaller hospitals can learn from interpretations performed at university hospitals. Easy access to specialised radiology competence can result in learning. Radiologists' communication with clinicians and clinical sub-specialists can give understanding of how they solve problems. When radiographers work at workstations they can learn more about image quality, and new ways of quality assurance (for example by image manipulation).

University hospitals can organize remote teaching and transmit this as videoconferences to all interested. But also smaller hospitals can invite resource persons and transmit lectures. Totally, more people can have access to resource persons. With new technology radiologists can access relevant information in electronic patient records (for example diagnosis, interpretations of pathology sections, and treatment results). When own work is viewed in light of such information, learning can occur.

Change in work processes

PACS and teleradiology can be viewed as tools for workflow, supporting communication and image flow, within and between hospitals. With an increasing volume of teleradiology the importance of distributing responsibility and tasks increases. All involved should have the same opinion about distribution of responsibility and tasks. Departments involved in teleradiology should together go through the steps of the production process and decide at each site who should perform which task, and who should have which responsibility. This can mean decentralization of responsibility to those performing the tasks. Decisions should be taken not only for ordinary production, but also for tackling of problems. Teleradiology collaboration can become somewhat chaotic without communication on how to collaborate. Good logistics is important for a well functioning teleradiology. Quick replies to clinicians can depend on a well functioning collaboration.

Departments involved in teleradiology collaboration should together go through the steps of the production process. All involved should have the same opinion about distribution of responsibility and tasks. This also applies to tackling of problems.

The capacity to capture images can be established in primary care, for example at places with a population of some size, or ski resorts with many fractured limbs. Ultrasound at primary care centres can become relevant.

Radiology can be important for episodes of care involving several levels of care. The question then comes up of where radiology should be performed. The capacity to capture images can be established in primary care, for example at places with a population of some size or ski resorts (many fractured legs). Images can be transmitted to a hospital where interpretation is done. Some patient travels are avoided, and more treatment can be done

locally. The technology can make ultrasound at primary care centres relevant. A primary care doctor can sit together with the patient and receive guidance from a radiologist about positioning of the ultrasound probe. The radiologist can view the ultrasound images on his/her own screen. In general patients in need of radiology can receive treatment earlier. Change in work processes can be positive for quality.

Consequences for the clinico-radiological conferences

In hospitals radiologists and clinicians traditionally meet daily at so called 'clinico-radiological conferences'. At these meetings radiologists review new images together with clinicians, and the radiologist tells his interpretation. The clinico-radiological conferences play a role for communicating interpretations to clinicians. With several doctors present the clinico-radiological conferences become very resource requiring. The new technology questions the future of such clinical review conferences. It has become unnecessary for clinicians to come to clinico-radiological conferences to see radiology images. They can look at images and read the radiologist's interpretation at monitors in own department. In future more radiology can be performed as teleradiology. In teleradiology distance between clinicians and radiologist makes it difficult to organize clinico-radiological conferences.

The new technology questions the future of clinico-radiological conferences. It has become unnecessary for clinicians to come to radiology departments to see radiology images and hear interpretations. In teleradiology distance between clinicians and radiologist makes it difficult to organize clinico-radiological conferences.

Productivity may be improved by abolishing clinico-radiological conferences. A hospital should abolish the clinico-radiological conferences only after consultation between radiology and clinical departments. The clinico-radiological conferences represent a possibility for questions and consultation between clinicians and radiologists.

For health care productivity is an important issue. Low productivity can result in less time for patient treatment. Implementation of PACS can have a positive effect on productivity, by for example decreasing time required to produce radiographs (Redfern et al. 2002). Productivity can also be improved by abolishing clinico-radiological conferences. Clinicians and radiologists can spend more time on treatment and interpretations, with a likely productivity gain. The involved can find it «meaningless that 20 physicians sit for one hour and watch images they can view at own monitor» (Aas & Geitung 2005).

In a Norwegian study (Aas & Geitung 2005) 29 % of the respondents told that clinico-radiological conferences can be abolished, 52 % no and 19 % both yes and no. The results do not give a clear indication of what should be done. This is illustrated by the following points mentioned by the respondents: The clinico-radiological conferences can be abolished for some clinical departments, but abolishment should occur only after consultation between radiology and clinical department. The clinico-radiological conferences represent a possibility for consultation and questions. At clinico-radiological conferences clinicians can discuss problems, students and fresh doctors ask questions. Also radiologists may wish to keep the conferences. They obtain dialogues with clinicians about how to examine the patients. When clinico-radiological conferences are abolished case discussions become more difficult to obtain.

Radiographers may view abolishment of clinico-radiological conferences as an advantage. Radiographers must wait till after the conference if they need assistance from radiologists.

If clinico-radiological conferences are abolished the question comes up what they should be replaced with. The clinico-radiological conferences can be replaced with monitors around at the hospital. At the monitors clinicians can view images, read interpretations, and in acute cases listen to the interpretation on a sound file. If they wish to discuss something clinicians can call the radiologist, or clinicians can organize meetings at own department together with radiologists. Clinico-radiological conferences can also be replaced by more goal-oriented meetings, like case conferences for special or interesting cases, or review conferences (weekly or more often) about patients radiologist and clinician want to discuss. For teleradiology videoconferences can be an alternative, but they are little used. With the new technology clinician and radiologist, at different locations, can look at the same image and speak together on the phone.

General traits of internal organizational consequences

The present chapter demonstrates internal organizational impacts as very common. There are many effects, several types of effects, and effects few in numbers can be in principle important. In spite of this, the general impression is that internal organizational consequences of telemedicine do not represent problems of a magnitude too difficult to tackle. The problems can require a quite pragmatic approach. Managers can take advantage from the experiences of others (like experiences published here) and implement necessary changes.

Internal organizational impacts are very common.

The problems can require a quite pragmatic approach.

For different applications of telemedicine we find different internal organizational consequences, but not only differences: For remote consultations and teleradiology sixteen similarities in internal organizational consequences have been identified.

Telemedicine remote consultations and teleradiology represent both synchronous and asynchronous ways of working. From chapter 2 we see that the asynchronous application seems to require implementation of more measures of collaboration. Internal organizational consequences, however, do not seem to be more difficult to deal with for teleradiology than for remote consultations. To avoid problems with remote consultations store-and-forward technology is an alternative (for example in teledermatology). In a study, store-and-forward has been found easier to incorporate into daily clinical work (Lam & MacKenzie 2005).

For so different applications of telemedicine it is not surprising that we find differences in internal organizational consequences, but not only differences. Sixteen similarities in internal organizational consequences have been identified, and they are listed here:

1) Total number of employees is not changed much, but shift in workload between sites can require work capacity changes.
2) Composition of personnel can change. Input from IT-personnel can be required for both remote consultations and teleradiology. Teleradiology, in itself, does not require large changes in composition of personnel (the greatest change is connected to PACS implementation).
3) Work tasks are changed.
4) Responsibility for telemedicine can be decentralized to those directly involved.
5) It can be necessary for colleagues to perform tasks while some are working with telemedicine.
6) Telemedicine may trigger discussions concerning sectioning of departments.
7) The organizations can use videoconferences for administrative meetings to coordinate activity at sites not co-located.
8) Communication on goal formulation seems to be of limited importance.
9) Learning is an important aspect of the new technology.
10) Champions and opponents of the change are often present, but champions are more common than opponents.
11) Equipment used for telemedicine should be easily available.
12) Telemedicine is a fundamental change in the work process.
13) Telemedicine can play a role for extended collaboration between hospitals and local health care and shift where diagnosis and treatment take place (i.e. to lower levels). This means internal changes for organizations on both sides of the network.
14) Telemedicine is often performed by organizations with ordinary production. This has consequences both for mangers and those directly involved in telemedicine.
15) Telemedicine may play a role for improved quality.
16) The relevance of organizational merger is increased. With merger problems, previously inter-organizational, become intra-organizational.

It is well known that different work processes can be used for the same task. This does not mean that every possible work process is equally good. The ideal is to use the work process resulting in best quality and productivity. Telemedicine and ordinary work processes are two different ways of solving the same task.

When telemedicine is not used the reason can be that it is more demanding for organizations.

Personnel supposed to work with telemedicine are embedded in organizations working traditionally. The ordinary way of working and the use of telemedicine may then come in conflict with each other. Managers must split their attention on two different production processes, and integrate them in the same organization. Personnel directly involved must engage in two ways of practising. Teleconsultations is an alternative worth considering for different medical specialities, but is hardly relevant for all. For specialities which rely on thorough physical examination, or specialized investigative techniques, the remote

consultation is less likely to be adopted. The use of telemedicine depends on degree of fit with the task (Lehoux et al 2002).

We have little information on a possible relationship between volume of telemedicine and organizational consequences. It is possible that more organizational consequences will be seen as the volume of telemedicine increases. In future, teleradiology will only be performed by departments having PACS, and a study of teleradiology based on older technology would soon be outdated. Implementation of PACS makes teleradiology easier and the change can stimulate teleradiology, but changing to PACS does not mean, in itself, having teleradiology. It should be noticed that distinguishing between what is the organizational effect of teleradiology and the effect of PACS can be difficult. When it comes to the three technologies (remote consultations, teleradiology, and PACS) it is well possible that implementing PACS results in the largest internal organizational consequences.

WHAT ORGANIZATIONS CAN DO

When telemedicine is implemented rethinking of internal organization should follow. It can be right to perform internal organizational changes together with implementation of collaboration measures. Internal organization problems are not so complex that they need a separate organizational treatment. Changing organization in regions (chapter 3) can be more complex to obtain, and it may be necessary to involve policy formulation level.

Changes in internal organization can be done together with implementation of collaboration measures.

In connection with the change, management should be proactive and involve users in change processes.

When telemedicine is implemented it is wise to inform the whole organization about the change.

Telemedicine is often about collaboration between organizations, but different organizations can have highly different organizational processes over time. This means that with telemedicine collaborating organizations must be willing to adjust to each other, listen to each other, and be sensitive to each other's needs. For a successful change involvement of management is essential. Management should be proactive (Chen et al. 2002) and not just wait until decisions are necessary. Focus can be on a number of factors, like: strategy and future oriented planning, monitoring of processes, monitoring of the result of decisions, reflection upon past experiences, empowering and involving personnel, collecting and disseminating information, analysis of task interdependencies, developing an organizational willingness to learn and an organizational culture positive to change, and managers should have good knowledge about the technology themselves.

With the total organizational effects of telemedicine in mind it is wise to inform the whole organization, when it is implemented, and especially prepare those working close to the

new activity. Management should involve users in change processes (Lorenzi et al. 1997), and be willing to listen to personnel. Good communication is important in a change process. Some among personnel are key actors and champions, and they should be involved. If telemedicine is to become a routine activity the dependency on the specially interested, and key actors, should be reduced (Linderoth 2002). Implementing PACS is a major change for radiology departments. After implementation of PACS it may be wise to consider having a break in the change work. There is a limit to how much change an organization can accept in a certain period of time. When the situation is mature, all routines are well worked in, and the personnel have experience in tackling problems with failing technology, the implementation work for teleradiology can start.

For the success of IT in health care strategy is important (Tähkäpää 2004). Traditional strategy for obtaining implementation (education in how to use the technology and ensuring the availability of technical support) is not enough. Personnel should be equipped with an understanding and a vision of the new situation so they can appreciate it. Such understanding can be built up by leadership and influential people in an organization (Zmud & Apple 1992). It has been proposed that cooperation between organizations is more easily obtained at operational level than at strategic level. At strategic level objectives are formulated and it is decided how they can be realised (van Gils 1984). When goal formulation is not found so important for telemedicine the explanation can be that initiatives have not been taken at strategic levels. A higher volume telemedicine requires reorganization for regions (chapter 3). To obtain such reorganization a regional strategic plan should be worked out. Regions will have to decide own organizations goals, for telemedicine and identify partners for the cooperation, most likely to fulfil the goals. Each organization should make strategic plans adapted to the regional plan. The telemedicine strategic plans should include an assessment of needs, and why telemedicine is a good way to meet these needs. The needs may be of two kinds: a) Patients' need for health care, b) Organizational and needs (for example to improve quality and lower costs). Little match between technology and needs may imply low volume of use. It is a mistake not to have performed needs assessment (Jennett 2003; Lam & MacKenzie 2005). There is no doubt that telemedicine costs, and this cannot be overlooked. A health care organization can have needs connected to different services. It is necessary to prioritise between telemedicine and fulfilment of other expenditure resulting needs. For telemedicine productivity is rather dependent on how organizations tackle the situation (Grigsby et al. 2002). The telemedicine potential can only be fully realised when organizational changes are made (Eason 2001; May et al. 2003; Sandkuhl & Fuchs-Kittowski 1999). Analysis of the future for telemedicine should include the situation after reorganization.

Organizations need a culture positive to change. Culture relates to the patterns of values and beliefs that people learn in their respective social environments (Chanlat 1997). Cultures support social value systems and the values define social control systems. Social control can help organizations in their work for goals (Lorenzi et al. 1997). Management has a role to play in promoting an organizational culture positive to change. For teleworking the culture of organizations, and managerial resistance, have been considered the main cause of slow growth in uptake (Chapman et al 1995). For organizations planning much use of telemedicine managers should communicate a positive view of the change. Much use of telemedicine can have consequences for selection of managers. Not all are equally well fitted. Managers adopting an open style with teleworkers have been found to foster improved communication between teleworkers and other members of the organization (Chapman et al 1995). An open style can mean participation in decision

making. Personnel involved in telemedicine may be influenced by the culture of collaborating organization, feel less identification with, and less commitment to own organization. A solution to the problem can be to select individuals who have been working with the organization for some time (Chapman et al 1995).

Personnel should be equipped with a positive vision of the new situation.

When goal formulation is not found so important for telemedicine the explanation can be that initiatives have not been taken at strategic levels.

For reorganization in regions strategic plans should be worked out. Each organization should make strategic plans adapted to the regional plan. The telemedicine strategic plans should include an assessment of needs.

Management has a role to play in promoting an organizational culture positive to the change.

Much use of telemedicine can have consequences for selection of managers. Not all are equally well fitted.

Personnel involved in telemedicine may be influenced by the culture of a collaborating organization. Telemedicine workers can be individuals who have been working for the organization for some time.

The presented empirical research clearly shows telemedicine plays a role for learning, and the term learning organizations becomes relevant. In future the thinking concerning formation of organizational networks can take into consideration the question of which network has the best learning effects.

The presented empirical research clearly shows telemedicine plays a role for learning. It is easy to propose that there are learning effects also for other applications of telemedicine. The learning effects should not be forgotten. When new technology plays a positive role for learning, and work organizations become an important arena for learning, the term learning organizations becomes relevant. Learning may be an unplanned by-product of telemedicine, but in learning organizations the learning becomes a part of an organized effort. The learning effect, in itself, can constitute an argument for implementing telemedicine. In future the thinking concerning formation of organizational networks can even take into consideration the question of which network has the best learning effects. Competence in each organization should be seen in relation to competence in potential collaborating organizations. Management to promote the intellectual capital of an organization may include management of relationships between employees to promote knowledge sharing, and to develop a learning organization culture and infrastructure (Senge et al. 1994; Snow et al. 1999). It has been proposed that a clearly hierarchic organization represents a hurdle for the flow of knowledge in organizations (Nikula 1999; Nordhaug 1993; Stead 1998). The answer may be decentralization of functions, change in organizational structure to a less centralized form, and delegation (Aas 1997). Use of multidisciplinary teams may also promote learning (Stead 1998; Ovretveit et al. 1997).

Summary
On a historic basis technology has formed existing work practises. Changes in diagnostic and treatment technologies have been proposed as the most potent force leading to the substitution of one form of health care service for another. Examples of historic technology changes are general anaesthesia, x-rays, antibiotics, psychopharmacologic drugs, and laparoscopic surgery. We are still at an early stage of development for total ICT effects.

TWO CASES OF INTERNAL ORGANIZATIONAL CHANGES
In the new century we have seen empirical studies giving information about internal organizational changes when telemedicine is used.

The case of the telemedicine remote consultation
For the telemedicine remote consultation a number of organizational factors are presented:

Change in organizational structure
New ways of coordination
Staffing changes
Co-operation with and change in relationships to others in own organization
Consequences for the work of those who do not participate directly
Changes in job situation
Champions and opponents of the technology
Goal formulation
Ideal number of remote consultations per week
Easily available equipment
Learning
Change in work processes

The case of teleradiology and PACS
Core functions of radiology are capturing images and interpreting images, but consulting is also a part of the work. Clinicians may consult radiologists and radiologists may consult clinicians. For teleradiology a number of organizational factors are presented:

Change in organizational structure
New ways of coordination
Staffing changes
Co-operation with and change in relationships to others in own organization
Consequences for the work of those who do not participate directly in capture and interpretation
Champions and opponents of the technology
Goal formulation
Easily available equipment
Learning

Change in work processes
Consequences for the clinico-radiological conferences

General traits of internal organizational consequences

Internal organizational consequences of telemedicine are very common. For different applications of telemedicine we find different internal organizational consequences, but not only differences. For remote consultations and teleradiology sixteen similarities in internal organizational consequences have been identified. When telemedicine is not used, the reason can be that it is more demanding for organizations.

WHAT ORGANIZATIONS CAN DO

When telemedicine is implemented rethinking of internal organization should follow. This presentation of organizational factors should give managers ideas about relevant organizational changes. Necessary changes do not seem too complex, and it can be right to perform internal organizational changes together with implementation of collaboration measures. In connection with the change management should be proactive and involve users in change processes. It is wise to inform the whole organization about the telemedicine change. Personnel should be equipped with a positive vision of the new situation. When goal formulation is not found so important for telemedicine the explanation can be that initiatives have not been taken at strategic levels.

Each organization should make strategic plans adapted to the regional strategic plan. Telemedicine strategic plans should include an assessment of needs. Management has a role to play in promoting an organizational culture positive to the change. Much use of telemedicine can have consequences for selection of managers. Not all are equally well fitted. Personnel involved in telemedicine may be influenced by the culture of collaborating organizations. Individuals who have been working for the organization for some time may be selected for telemedicine work. Empirical research clearly shows that telemedicine plays a role for learning, and the term learning organizations becomes relevant. For the formation of organizational networks, the network which has the best learning effects may be considered. Competence in each organization should be seen in relation to competence in potential collaborating organizations.

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Concluding remarks

Time has come for work with
organizational problems.

What will be the future of telemedicine? Forecasting future developments is not necessarily easy. Many have failed, even failed about the future of concrete technologies. The man who invented the telephone in 1875, Alexander Graham Bell, believed the telephone would be used for listening to concerts. The president of the well known computer company DEC, Ken Olson, said in 1977 that there was no reason for any human being to have a computer in the home. One with success in forecasting was Jules Verne. His book 'From the earth to the moon' is well known. In one of his books he proposed a future with weapons so effective that all life could be made extinct. In 1863 the publisher refused printing with the remark that 'no one will today believe in your prophesy' (Steinsland 1998).

No organization is problem-free and a new way of working (like telemedicine) often means change in organization. This again may well mean new problems. But problems in organizations are not just problems. Problems in organizations can be problems for which solutions can be designed. This way of thinking is far from indifferent for the telemedicine's future.

Forecasting future developments can be difficult.

Problems in organizations can be problems for which solutions can be designed.

The present book has focus on organizational issues with a main feature consisting of two points:

1) Identification of organizational problems
2) Design of solution to the organizational problems

Regional reorganization for more telemedicine

In spite of the many champions, in spite of that more than 15 years now have passed since the start of a new era for telemedicine, the many projects, and the resources applied telemedicine has not been spreading like fire in dry grass. Telemedicine has a diffusion problem. Diffusion is defined as 'the process in which an innovation is communicated through certain channels over time among the members of a social system' (Rogers 2003). Innovations are often technologies and telemedicine is definable as an innovation for health care organizations (Grigsby et al. 2002; Rogers 2003; Strömgren 2003). The interest for diffusion, in general, has been significant in the international research community. We find many studies of diffusion and a well-known book has more than 3000 references (Rogers 2003). For diffusion of telemedicine we find few publications. It should be noticed that problems with diffusion of technology are nothing new and diffusion is decided by a number of factors (Grigsby et al. 2002; Rogers 2003). Diffusion of many innovations

follows a pattern with a slow increase in the start. When 'critical mass' is reached the diffusion speeds up, then it slows down, and become zero when the diffusion is over. Diffusion is often illustrated by an S-shaped curve.

In Norway diffusion of telemedicine has occurred much as projects and trials and less as direct adoption as a routine service into every day practise. From international research we know there is a risk that telemedicine disappears when project funding, or champions, disappear (May et al 2003). Experiences from Norway confirm this. Telemedicine can be dependent on champions and disappear when the champion leave for a new job. Although the interest for telemedicine in Norway has been great, telemedicine is still a small activity. Production of health services by telemedicine is marginal, compared to the total production in health care. The same seems to be the case in the UK and USA (May et al 2003). A significant diffusion and great volume of telemedicine is harder to obtain than many believed in the 1990ies. Some consider the slow diffusion of telemedicine is as expected (Grigsby et al 2002).

Telemedicine has not been spreading like fire in dry grass. Telemedicine has a diffusion problem.

Production of health services by telemedicine is marginal, compared to the total production in health care.

Believing that a greater diffusion of telemedicine, and a greater volume of use, will be obtained by itself, just because the technology is so good, is a mistake.

To obtain a greater diffusion of telemedicine, and a greater volume of use, it is necessary to think in terms of regional reorganization.

Believing that a greater diffusion of telemedicine, and a greater volume of use, will be obtained by itself, just because the technology is so good, is a mistake. The technology in itself is neither good nor bad, but notice: it is definitely not organizationally neutral. It is not enough with the aid of champions. More is required. Chapter 3 of the present book shows the importance of regional reorganization. To obtain a greater diffusion of telemedicine, and a greater volume of use, it is necessary to think in terms of such reorganization. The chapter shows how such reorganization can be obtained. For telemedicine to be perceived as meaningful a need should be present (Al-Qirim 2005; Jennett 2003). It should be possible for management to point at either a clinical need or an organizational need (for example to deliver a service cheaper to remote locations, to use telemedicine for competence complementation and learning). Without a need being present reorganization can be resisted. A mapping of local factors should then be made, i.e. facilitators and barriers to reorganization in own region. Such information can be obtained by qualitative interviews of key employees in the regions' health organizations. To obtain a policy for change for the total region focus groups can go through the collected information. When the problem is diffusion the solution may well be what is found in chapter 3.

Collaboration measures and change in internal organization for more telemedicine

The research presented in chapter 2 is about collaboration. Telemedicine requires collaboration through telecommunications. The chapter shows several problems with telemedicine collaboration, but it should be noticed that solutions exist to the collaboration problems. The solutions are called measures of collaboration. It seems that telemedicine collaboration can be made to work well. Managers should lead change processes in their organizations, where the different issues of importance for collaboration are treated, and measures are taken to fully realise the telemedicine potential.

Internal organizational consequences are presented in chapter 6. Internal organizational consequences of telemedicine are very common and expectable when telemedicine is implemented. These consequences should not just be viewed as problems. Rather, managers should view them in a pragmatic way, i.e. as problems that need to be solved and can be solved. Solutions to the internal organizational problems can be implemented together with measures of collaboration.

The transformation of telemedicine from project to routine activity represents a significant shift. Telemedicine as a routine activity cannot just be dependent on champions. For organizations wishing to go further, after the project stage (when special funding and champions are not there), focus should be directed towards measures of collaboration and internal organizational problems. The potential of telemedicine can only be fully realised if implementation is accompanied by organizational changes.

Telemedicine collaboration can be made to work well. Measures of collaboration should be implemented.

Solutions to the internal organizational problems can be implemented together with measures of collaboration.

Tools of health policy

Financing methods. Research has shown economic incentives to influence decisions, and this also applies to health care (Aas 1995). Financing methods are important tools of health policy. Different incentives can be introduced by implementing different financing methods. All activity in health care must be financed. Lack of reimbursement of telemedicine can be a problem. If fee-for-service is used reimbursement can be adapted to cost level. Financing telemedicine in this way may lead to work, which could have been performed in the ordinary way, being performed as telemedicine. Telemedicine may cost more than ordinary activity and total costs may then increase. The body paying the bills can then deny paying for telemedicine. For example paying for teleradiology can lead to too many second opinions. Paying for remote consultations in psychiatry raises the question of upon which criteria telepsychiatry can be used. Psychiatrists do not agree on clinical criteria for telepsychiatry (Aas 2001). In general we find a need for developing criteria and guidelines for telemedicine (Loane & Wootton 2002; Stanberry 2006). Information about telemedicine work can be stored in computers and payment occurs when decided criteria are satisfied.

Legal problems. Legislation is an important tool of health policy. Legislation states principles for regulation of the health sector. In the telemedicine community legal problems have often been mentioned. Several legal factors have been considered relevant, like liability, confidentiality, licensure, and retention of records (Mun et al. 2005). The question of liability is well known (Stanberry 2006; Mun et al. 2005). The referring physician has a greater responsibility by applying advise from a distance (Lehoux et al 2002). If refereeing physician implements treatment based on advise from a remote consultant, and something goes wrong (for example an unexpected development in medical situation), who is then responsible? It is also possible that referring physician disagrees with the specialist. What should then be done? Medical decisions can be evaluated against 'standard of practise accepted by a group of health care professionals practising in the same speciality' (Stanberry 2006). If such standard is not satisfied we are speaking about malpractice (Aas 1991). Each person involved in telemedicine can be responsible for own evaluations (Telemedisin og ansvarsforhold 2001). Remote consultations can be videotaped and the tape has the status of a legal document. If referring doctor and specialist disagree about diagnosis or treatment a third specialist can be asked to give his opinion. Confidentiality has both an ethical side and a legal side. In telemedicine we can have an extensive flow of information in electronic networks. The requirement of confidentiality faces new problems. The question of who is responsible for what should be clarified. Own organizations can be established to take care of the physical side of the electronic networks. Such organizations can be made responsible for security, for example to make unwanted downloading impossible. Access to workstations can be supervised by organizations having workstations, for example that passwords are given only to persons needing access. When it comes to legal problems, international telemedicine is maybe most problematic. For example which country's law is to be applied in the case of problems? How can license to practise be controlled? How can information about previous malpractice cases be obtained? How should country differences in standards for treatment and diagnosis be tackled if problems come up? In addition we have cultural and linguistic barriers.

A Norwegian law firm reviewed the situation, but could not confirm Norway's legislation to represent an insurmountable barrier for telemedicine (Juridiske barrierer for bredbåndsanvendelser i offentlig sektor 2004). It should also be noticed that legislation, in general, should not block a country's development. On a historic basis legislation has changed as society has changed. If necessary, measures should be taken to adapt legislation to a new situation.

Cost-effectiveness

Telemedicine raises the question of what to prioritize. Should telemedicine or other changes in the organizations have priority? In health economics we find a tool for prioritising in the four types of economic analyses: Cost-minimization-, cost-effectiveness-, cost-utility-, and cost-benefit- analysis. The results from CMA, CEA, CUA, CBA research can be used to prioritize between treatments, diagnostic methods, and programmes for prevention. Not only costs are taken into consideration, but also consequences for patients. Totally, economists have performed a very high number of such analyses. Even early in the 1990ies two international journals published bibliographies listing 3200 and 1900 references (Medical Care 1993; Health Economics 1992). An updated bibliography published in 1998 had 3500 references (Medical Care 1998). The practical importance of this research has not been great. The influence on decisions in health care is limited (Aas 1999). Several have made such economic analyses of

telemedicine (Whitten et al. 2002). It is not necessarily so that this research is likely to have greater influence on the future of telemedicine. The future of telemedicine may well be decided by other factors. In the process shaping health care's future we find many actors (like mass media, politicians, professions, researchers, patient organizations). For example vendors of telemedicine equipment make money on convincing potential buyers. Health managers may doubt the applicability of cost-effectiveness research to own organization (the generalizability of the research). It does not make it easier that assuming telemedicine to be cost effective is not confirmed by research (Kristiansen & Poulsen 2000; Whitten et al. 2002), and it is unclear whether telemedicine has a beneficial effect on productivity (Grigsby et al 2002).

The future for telemedicine

Patient and provider satisfaction do not seem to be great problems for telemedicine (Mair & Whitten 2000; Whitten & Love 2005). Neither do tools of health policy solve, or represent insurmountable, problems for telemedicine's future. Cost-effectiveness studies do not represent a definite argument for, or against, telemedicine.

At its present stage of development telehomecare may look like a promising application (virtual visits to the home and medical monitoring in the home). Telehomecare is a cheaper alternative, and is especially relevant for some groups of the chronically ill, disabled, long-term rehabilitation patients, and patients not requiring continuous presence or the equipment of a hospital (Aas 2004). Population prognoses report of significant future increases in the number of elderly in many countries. The extra workload can become a driving force for telehomecare.

Telemedicine is a 'technical fix' for the distance problem. Working with telemedicine means having organizations behind clicks not bricks. It is a great misunderstanding to believe the telemedicine virtual organization not to require focus on organizations' measures. Collaboration measures should be implemented, necessary changes should be made in internal organization, and regional organization can be changed. In future organizations will not necessarily be the main problem, but organizations can be changed to facilitators for telemedicine. Forecasting the future for telemedicine is difficult. Much depends on decisions taken by the health care organizations, but organizations do not decide on the basis of a simple rationality. From organizational research the term 'the irrational organization' is famous (Brunsson 1985). What organizations decide in the future is difficult to predict. Prophesies telling the death of telemedicine, or that it is omnipotent, should not be believed in. The future for telemedicine may become more complex. For telemedicine to have a proper chance focus should be shifted over to organizational issues. Time has come for work and sweat with the organizational problems.

It is a great misunderstanding to believe that telemedicine does not require focus on organizational measures.

If health care tackles the situation correctly organizations will not necessarily be the main future problem. Rather organizations can be changed to become facilitators for telemedicine.

Forecasting the future for telemedicine is difficult. Much depends on decisions taken by the health care organizations.

Time has come for work with the organizational problems.

SUMMARY

Forecasting future developments is not necessarily easy. Many have failed, even failed about the future of concrete technologies. The present book has focus on organizational issues with a main feature consisting of two points:

1) Identification of organizational problems
2) Design of solution to the organizational problems

Regional reorganization for more telemedicine

Telemedicine has a diffusion problem. Problems with diffusion of technology are nothing new. Production of health services by telemedicine is marginal, compared to the total production in health care. To believe that a greater diffusion of telemedicine, and a greater volume of use, will be obtained by itself, just because the technology is so good, is a mistake. To obtain a greater diffusion of telemedicine, and a greater volume of use, it is necessary to think in terms of regional reorganization. For telemedicine to be perceived as meaningful by employees, a need should be present.

Collaboration measures and change in internal organization for more telemedicine

The transformation of telemedicine from project to routine activity represents a significant shift. Telemedicine as a routine activity cannot just be dependent on champions. For organizations wishing to go further, after the project stage, focus should be directed towards measures of collaboration and internal organizational problems. The potential of telemedicine can only be fully realised if implementation is accompanied by organizational changes.

Tools of health policy

Lack of reimbursement of telemedicine can be a problem. If fee-for-service is used, reimbursement can be adapted to cost level. Financing telemedicine in this way may lead to work, which could have been performed in the ordinary way, being performed as telemedicine. In general we find a need for developing criteria and guidelines for telemedicine.

In the telemedicine community legal problems have often been mentioned. The question of liability is well known. Each involved in telemedicine can be responsible for own evaluations. The requirement of confidentiality faces new problems. When it comes to legal problems, international telemedicine is maybe most problematic. A Norwegian law firm could not confirm Norway's legislation to represent an insurmountable barrier for telemedicine.

Cost-effectiveness

In health economics we find a tool for prioritising in the four types of economic analyses: Cost-minimization-, cost-effectiveness-, cost-utility-, and cost-benefitanalysis. Several have made such economic analyses of telemedicine. It is not necessarily so that this research is likely to have greater influence on the future of telemedicine. The results from cost-effectiveness do not give a clear indication of telemedicine's cost-effectiveness, or lack of such. It is also unclear whether telemedicine has a beneficial effect on productivity.

The future for telemedicine

It is a great misunderstanding to believe the telemedicine virtual organization not to require focus on organizations' measures. In future organizations will not necessarily be the main problem, but organizations can be changed to facilitators for telemedicine. Forecasting the future for telemedicine is difficult. Much depends on decisions taken by the health care organizations. For telemedicine to have a proper chance focus should be shifted over to organizational issues. Time has come for work and sweat with the organizational problems.

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