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Supporting a high quality Diagnostic Procedure through Multi-disciplinary Collaboration between Medical Specialists

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Abstract. bla bla

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Introduction

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Comparison with communities of practice, the driving forces of such groupings, the role of practice - all such things that can be identified in the consensus meetings. Focus on learning as social participation (Wenger 1997).

About common ground, tacit knowledge,...

Background

In the beginning of the 21st century, the Swedish health care authorities decided that ordinary health care should be close and easily available in the nearby community, but that highly specialised health care should be concentrated to the university hospitals. The management of health care is divided among 21 councils

in Sweden. There are eight university hospitals in Sweden, among which one is Karolinska University Hospital, situated in Stockholm County Council (SLL) with approximately 1.6 million inhabitants. In 2003, SLL decided that the highly specialised surgery within the upper gastrointestinal tract (concerning the upper part of the abdomen: liver, gall bladder, pancreas, and esophagus/ventricle) should be concentrated to the section of upper gastrointestinal surgery at Karolinska (GastroCentrum) (before, the same surgery was located to five different hospitals). The ambition with concentrating such highly specialised surgery has been to, within approximately the same budget as the years before, achieve higher quality health care, become more efficient when treating the patient, and to create better possibilities for development and research within the health care area. In turn, this will lead to a safer and more cost efficient health care.

To achieve these goals and, thereby, provide the best possible care for the patient, a coherent network based health care process has been developed and implemented at GastroCentrum. One part of the process involves the establishment of a tele-medicine based multi-site network to accomplish geographically distant meetings, especially multi-disciplinary conferences held between GastroCentrum at Karolinska and the other surgical departments within the Stockholm region hospitals. The network participants collaboratively decide about the best treatment of all patients with sever diseases in the upper gastrointestinal tract from any referral hospital within the network. Ongoing, partnership hospitals outside of SLL are also connected to the multi-site network, and it is in the process to connect hospitals outside of Sweden.

Multi-disciplinary conferences are part of a work model where the primary hospital (the local hospital in which the patient gets his or her ordinary health care) first investigates the patient (taking samples and radiology pictures in order to make a first diagnosis). When the medical material about the patient is completed and the first diagnostic shows the needs of referrals, the patient is scheduled for the video-mediated multi-disciplinary conference where, among others, the patient's local hospital participates. During the conference it is decided how the patient should be treated, locally or at Karolinska. It can also be decided that further investigations are needed at the local hospital or at Karolinska. If it is decided that the patient should have surgery, then he or she will be "prepared" as far as possible at the local hospital, before being operated at Karolinska. The surgeon from the local hospital, who referred the patient, may participate in the operation. The aftercare (postoperative rehabilitation) of the patient, after the surgery and when the patient is well enough, is concentrated to a, for the purpose, specialised hospital within the Stockholm region, before returning home.

The model of concentrating highly specialised surgery to GastroCentrum is based on an active partnership with hospitals where referring units actively take part in investigations, decisions, planning, implementation, and following up of their patients. In such a network, Karolinska has the role of competence and resource centre for the health care region, is the "owner of the process", and is responsible for organising the partnership and the medical resources. Together,

the participants in the network are responsible for that all assessed patients will get the best possible competence when making diagnosis and decisions, and that a qualitative follow up, i.e., documentation in health care registers and research, are organised in an optimal way. The network also provides for spontaneous knowledge diffusion about best practices as well as new methods for investigations, treatments, routines, etc., within the network.

Methods

Our study is in its initial phase and based on close inter-disciplinary collaboration between researchers within the fields of Human-Computer Interaction, Medical Informatics, and Surgery, and medically trained personnel responsible for the health care process, and for the technical and practical implementation of the process. We have also involved students from the HCI-program at KTH to conduct their project work as part of our study, with the aim to "fine-tune" both the collaborative methods and the technical settings used at Karolinska and the referral hospitals.

During a period of six months we have conducted observations and interviews within the premises at GastroCentrum. Observations have been made (i) during conferences between different hospitals, (ii) during meetings with patients that have been referred but not yet been discussed at a conference, (iii) with patients that have been operated or being treated in other ways, and (iiii) with a surgeon responsible for the patients that have recently been undergoing surgery and are still cared for at GastroCentrum. A corpus of materials has been collected which includes field notes, video and sound recordings, copies of documents, drawings and other specifications which are important to the work and so forth.

Broadly, our orientation to field research follows the program of "ethnomethodological ethnography" as exemplified in CSCW by Hughes et al. (1992) amongst several others. Our emphasis is on the description of the observable features of the work in terms which organisation members themselves would recognise. By using ethnographic methods, we describe the details in how the medical specialists from different disciplines collaborate to make diagnoses and decisions in consensus (medical as well as administrative). Such descriptions, rich in details, will make it possible to propose methods and technologies that support the diagnostic procedure, to be able to introduce the same work pattern to other specialities.

The Setting

GastroCentrum

At GastroCentrum, there are about 25 surgeons, highly specialised on all complicated diseases in the upper part of the gastrointestinal tract, especially cancer surgery. The section for upper gastrointestinal surgery have a close

collaboration with several other units, e.g., transplantation surgery, pathology, radiology and internal medicine, just to mention a few. Within the section, research is conducted within a broad area of topics, e.g., gastrointestinal cancer, stress, metabolism, and nutrition. The section also conducts development work within surgery, heath care processes and telemedicine.

Before the network based health care process

The health care process used at GastroCentrum today was first introduced in 2004. Before, when a patient had been referred to the care at GastroCentrum all investigations, decisions, intervention, and after care were performed at the Karolinska in Huddinge. The patient had to travel to Karolinska, usually several times, for investigations (x-ray, consultations, etc), before any decisions could be made about the patient's treatment plan. Not only did the patient have a large amount of uncomfortable travelling, the referral hospital was usually not involved in the care process. All experiences and knowledge around the diseases were kept within Karolinska, with no routines or possibility for the referral hospital to learn. The local concentration of investigations and the many patients led to a saturation of resources at Karolinska.

The surgeon at Karolinska has the medical responsibility for the patient, i.e., the surgeon is responsible for the decision that is made in the end. The decision is based on the judgment and diagnosis made by the radiologist, oncologist, pathologist, etc. Before the health care process the surgeon met or spoke with the involved specialists individually, but some clinics also had the routine of arranging local multi-disciplinary conferences.

When SLL decided that GastroCentrum should perform this highly specialized surgery, a centre of excellence at Karolinska was given the task to secure patient treatment, education, research and development within gastrointestinal diseases on a regional, national and international level. The centre reported the need of a new network based health care process including all levels of medical involvement from the referral hospitals, a tele-medicine application as an enabler for this process, and a process owner that would secure the function of the process. A long-term specialist team, including two surgeons, one radiologist and one system manager, was established to do parallel work on two projects. Today, three of the four persons are still active in the team.

The first project focused on developing a network based health care process involving all referral hospitals. The process was designed to optimize knowledge, competence, resources, and patient safety at all levels. Within the process, GastroCentrum is the central competence and resource centre with the responsibility to organize the care chain and to allocate resources.

The second project was a pilot study in which a point-to-point tele-medicine link (so called video-radiology) was established between the radiological departments at Karolinska in Huddinge and in Solna. The purpose with the tele-medicine link was to create a technical infrastructure for network based multi-disciplinary treatment and decision conferences, i.e., conferences that would

enable the new health care process. The technical infrastructure secured that all local health resources and medical specialists could be integrated and take part in the examination and treatment of the patient. The technology was ready to be tested during the summer 2004. During the fall 2004 it was used between Karolinska in Huddinge and Solna.

The pilot study was considered successful and the next step was to involve other local hospitals within the region. In parallel with getting approval for the health care process within the local hospitals, the team also worked with the technological and economical conditions for including more hospitals to the network. In June 2005 everything was set for the technological infrastructure and the installations at four local hospitals were finished in the beginning of 2006.

The health care process for gastrointestinal surgery

The network based health care process at GastroCentrum was ready to be used in full scale in the beginning of 2006. The *co-ordinator* of the process, a highly experienced surgeon that has been appointed this role for a period of three to six weeks, has the over-all responsibility of and co-ordinates the process. When a patient first enters the process, typically when being referred by a doctor from a local hospital, the co-ordinator has the responsibility to make a first judgement about the medical material that has been collected at the local hospital.

In the initial phase of the process, the co-ordinator establishes a health care plan for the patient. Together with the referring doctor, the co-ordinator organises the investigation needed to accomplish a collection of optimal medical material for the upcoming consensus meeting. The medical material consists of a diagnostic part and an evaluation of how well the patient can manage complicated surgery.

The second phase of the process is the multi-disciplinary video-mediated conference. Together, specialists with competence in radiology, surgery, transplantation surgery, pathology, oncology, internal medicine, and anaesthesiology, from different hospitals within the multi-site network, with knowledge about the patient and experience from similar cases within their field, come to a consensus about how to proceed with the treatment. Conferences are held three times per week, one within each field of surgery at GastroCentrum: liver, pancreas, and esofagus/ventricle. An optimal conference consists of three parts. In the first part, the participants discuss and come to a consensus about how to treat the patient. Typically five to ten patients are discussed during one hour. In the second part, the patients that are scheduled for an operation are discussed, focusing on the details of how the operation will be performed and what is important to keep in mind. In the third part, patients who have been operated and are no longer part of the process are discussed, focusing on what was done, how successful the treatment was, the costs of the treatment, etc. Today, only the pancreas conferences consist of all three parts. In all, a consensus meeting takes one to one and a half hour, and the number of participating hospitals varies between two to six.

The third phase of the process is optimisation before the operation. The patient needs to be prepared for the operation, both physically and mentally. Do accomplish this the patient meets with all necessary competencies that decide about his or her needs before, during and after the operation. The rehabilitation and aftercare is also planned, as well as if the patient should be part of any research studies.

The fourth phaes of the process is the operation itself. The operation is usually conducted in collaboration between the surgeon at GastroCentrum and the referring surgeon. There is an intermediary care the first two to three days after the operation, unless intensive care is needed, in order to quickly be able to diagnose and respond to complications. After the intermediary care the patient is cared for at the nursing ward of GastroCentrum

The fifth phase of the process is the after care and rehabilitation. When the patient is stable enough, he or she is moved to after care for surgical rehabilitation in another hospital. The rehabilitation starts already at the nursing ward, and is then continued by the after care.

The tele-medicine technology

The communication links between the hospitals consist of both video and audio, connected via a video-bridge allowing for ten hospitals to be participate at the same time. At each hospital location, a video system cabinet (video-radiology) are connected to the radiologists' workstation. The cabinet copies two video signals from the workstation, displaying x-ray images through two video projectors. The two video signals go, via a video splitter and other hardware, to two video codecs. To enable an easy management for the radiologists, all system management, i.e., turning on the system, running local or multi-site conferences, using audio and camera management, etc, is done through a touch screen. In this video radiology setup, no modifications are made at the radiologists' workstation, only a copy of the video signals is used. Hence, the system is transparent to any vendors DICOM standard and enable both an easy and quick installation, and a short start-up time for the users. All installations consist of four phases: 1) pre-visit, 2), installation, 3) teaching how to use and simple trouble-shooting, and 4) regular follow-up meetings when in use.

The radiologist can, via the touch screen, choose between a local or remote presentation of x-ray pictures. When a remote conference is chosen, the connection is made via a high bandwidth video bridge (MCU), which can handle ten dual video connections simultaneously. During a remote presentation, the participants at different locations can see each other via a 50 inch plasma screen. They can also see the radiologist pictures on two screens, one presenting the radiologist's view of flat x-ray, and the other presenting the MR and CT. At each location two echo-handling microphones are installed in the ceiling.

Video and audio quality are important factors in the video-mediated meetings. The bandwidth used during the meetings needs to be sufficient to support audio and video quality, i.e., to pick-up subtle nuances in voices, and to secure that the

movements of images does not produce blurry pictures at the receiving hospitals. The video-radiology system uses 1.5 Mbit/s (768 up and 768 down) bandwidths. The video protocol, H323, traverses several firewalls of different types.

The MCU is leased by the SLL for three years and local video equipment (video radiology) has been purchased by SLL. All equipment is owned by SLL and made available for the hospitals participating in the multi-site network. The process owner for the consensus network has appointed one system director to run the system together with local technicians at each location. The director is also in charge to expand the system to new partners.

Results

Mutli-disciplinary conferences

Multi-disciplinary conferences, or consensus meetings, are held every week within the areas of liver, pancreas, and esophagus/ventricle. Focus within these conferences is on how to treat the patients that are scheduled for discussion. The medical material of each patient is used to discuss the diagnosis made, if there are unclear things that need to be further investigated, the results from samples made, etc., all in order to come to a consensus about the best possible treatment for the patient. Before a conference all medical information about each patient that will be discussed during the meeting are sent to the medical doctors involved in the patient.

Each conference has a chair and a responsible surgeon that is appointed through a scheduling process at GastroCentrum. The chair is running the conference MORE The responsible surgeon is supposed to read the medical material for each patient and prioritise the time spent on each patient. Based on the medical material and diagnostic investigation, he or she prepares a suggestion for how to treat the patient. The surgeon is also responsible for structuring the conference based on the participating members in order to make it practically possible to attend the meeting for the external participants. Finally, after the conference the surgeon dictates the decisions made during the conference, focusing on who participated in the decision, the implications of the decision, what treatments the decision implies, and who is responsible for implementing the treatments.

Each patient discussion at a conference starts by the referring doctor or the responsible surgeon shortly introducing the medical information. Thereafter, the radiologist, in combination with showing MRI, CT and/or other x-rays (see Figure 1), explains the radiological diagnosis made. All sites see the same pictures that are shown by the radiologist. At this time there are usually a lot of discussion and clarification among the members of the conference. For some patients the diagnosis is clear and it is obvious how to treat the patient. For others, either the diagnosis or the treatment may need to be discussed more intensely. In some cases, the discussion concerns how other patients with similar diagnosis

have been treated, and what kind of implications that could have for this patient. In other cases, it can be difficult for the members of the conference to come to a consensus because it may not be clear whether it is tumour or not, whether the patient is resectable or if the tumour involves other vital structures that make the patient irresectable, whether the patient is well enough to manage an operation or not, etc. If the patient cannot be subjected for operation, then other treatment options will be judged. In the end of each patient discussion, a final decision about how to proceed with the specific patient is always made. If the medical material is insufficient to make a decision, then it is decided what further investigations that are necessary to complete the material.

Photo: Dr. Nils Albin, radiologist at Karolinska

Figure 1 A multi-disciplinary conference at Karolinska. To the right, we can see the screen on the wall on which radiology pictures are shown via video projectors in the ceiling. The plasma screen in the middle shows the other site that was active talking last. The radiologists are sitting by the computers in the middle. The co-ordinator and the surgeon responsible are sitting in the middle of the front row, with a desk in the front of them. The rest of the audience are members of the conference. All sites are configured in the same way.

To give a richer picture of what is discussed, we will show an excerpt from the observation notes. The patient discussion involves the surgeon under specialist education, Hans, a radiologist, Ben, and the responsible surgeon, Ann, and two highly experienced surgeons, Lucas and Frans (KOLLA TURERNA HÄR):

Hans tells the background of the patients' medical information: "… colon cancer … cytostatic … ultra sound December 2006 … came in acute in March … vomits … done ERCP …"

Frans: "… young woman … judged receptable (RECIDICFRI, KOLLA)

Ben: "[we did] an ERCP in March … CT also in March … here is a tumour close to the papilla … 1.5 cm in size … changes in the left kidney … tumour unclear … [Ben changes the picture to pancreas] … the widening of the pancreas' main path …"

Ann: "it is the papilla then"

…

Lucas: “[have you been] going through her chest, the lungs?

Ben: “no, I have not done that”

Lucas: “because that liquid is troubling”

…

Frans: “… there is a connection [between two cancer forms] … two possible sources to that … under the condition that she does not have anything in the lungs or the kidney”

Lucas: “what do we do if it is in the kidney, you radiologists who now such things?”

…

Ann: “ … order CT and turn to Thorax [heart clinic]” … “ and consult the urology”

Lucas: “show us some of that lung again”

The radiologist change the picture

Lucas: ”… and an good old x-ray of the lungs because they usually want that”

…

Several others at the same time: “completely unnecessary”

Unknown medical doctor: “… do a PET …”

Several others at the same time: “good point”

Ann concludes the case

The discussion points at some interesting aspects. It shows that it was not clear how this patient should be treated. The diagnosis was clear in that the patient had a cancer tumour and where it was located. However, in order to know how to treat the patient, more detailed information about the tumour was needed. The medical doctors could not find an answer to the liquid. It was decided that the patient should do more investigations to be sure about how the tumour is behaving. The excerpt also shows that despite that Lucas is a highly skilled surgeon, and in a high hierarchical position, the other objected to his suggestion of “a good old x-ray of the lungs”. Finally, the excerpt shows moments of learning from others. Lucas is asking the radiologist what happens if there is something found in the lungs as well.

In the pancreas conferences, when all patients scheduled for the conference have been discussed, focus is directed towards patients that are scheduled for an operation within the next week and those that have been operated. During the post-operative discussions, cases that have been ended are shortly briefed in what was done, how successful the treatment was, the costs of the treatment, etc. Jenny and Paul, two radiologists, pointed out how important the post-operative discussion is:

Paul: when the patient has been operated and you have a diagnosis and feedback, was it right what we said from the beginning. And they have that in pancreas. It is incredible good and it is a must if we want to learn more.

Jenny: At these [pre]-operation and post-op[eration] [discussions], it is so far the case that the others have left, it is seldom anyone that stays from another site [other than Karolinska in Huddinge].

Paul: The pre-operative I can understand, but the post-operative, I think they are the best part of the week, when you actually get to know if you should hide or if you can go outside again.

The main purpose with these video-mediated conferences is to involve the local hospitals in the care of the patient and to use local resources when investigating and diagnosing the patient. Before the technical infrastructure was installed the patient had to travel to Karolinska in Huddinge, and no local hospitals were involved in the care process unless the medical personnel were ready to travel to Huddinge. The inter-disciplinary conferences were, to some extent, used locally at Huddinge before the network based care process. The network based care process formalises the procedure of having such conferences when coming to a consensus about how to treat the patient. The video-mediated conferences allow more people to attend and take part in these discussions.

Multi-disciplinary diagnostic discussions

The network based health care process, and the conferences in particular, provides a unique opportunity for medical doctors within different disciplines to meet and come to a consensus on how to best treat the patient, to learn from each others professions, and to share best practices. It is also of major importance to have members from all involved medical disciplines present during a conference. A missing discipline may not only make it difficult to come to a consensus about how to treat the patient, but can also make it difficult to keep the discussion focused. A patient discussion is dependent on the right knowledge being available there and then, when the decisions are made.

The discussion at a conference must be short and informative. The conferences take quite a lot of time as it is, even though the process itself saves time in the end. Bob, a senior surgeon, said during an interview:

It takes a lot of time as it is. There are an extreme amount of preparations, not least for the radiologists. But that is how it needs to be, because it is complicated cases. It is still an extreme saving of time spent, but we start reaching a limit of what we can take with the number of employees we have.

Only the necessary information about the patient is communicated. Despite the participants' different disciplines, they have a common ground around the specific gastrointestinal diseases that the patients are diagnosed with. By excluding irrelevant information, the participants can focus on the information that is of relevance. This process of "exformation" is dependent on the collective knowledge of the participants. If one or several competencies are missing from the meeting, the exformation process becomes incomplete and it becomes more difficult to keep the discussion focused. Thus, this multi-disciplinary approach at the conferences is beneficial in all circumstances.

The complicated diseases treated at GastroCentrum call for a highly specialised multi-disciplinary network based health care process. Not only

surgeons are involved in making the decision if a tumour is operable or not, but also several other disciplines. Examples of questions discussed are: Is the tumour in the liver a metastasis of a tumour in the colon? What opinion does the pathologist have regarding this matter? Can the patient go on living with ¼th of a liver after an operation? The skills of the radiologist, oncologist, pathologist, transplantation surgeons etc, are necessary in order to come to the best possible decision about how to treat the patient. The opportunities given by a multi-disciplinary conference, to discuss the diagnosis made and how to treat the patient, provide for a rich discussion and understanding. A discussion richer than if the surgeon alone would either read the notes from or talk to all involved disciplines separately. This is strengthened by the results from interviews. When asked about if these conferences result in better decisions, Bob, a senior surgeon, replied:

Well, there has not been any formal evaluation or so on that, but the impression is that [it results in better decisions], absolutely.

The discussions during the conferences provide a moment of learning from each other, both across and within the disciplines. When the more experienced, and thereby skilled, doctors present their theories and arguments, this is an opportunity for the others to learn and get reflections about methods, research, theories or best practices. When the radiologists show and explain the pictures, the audience gets a richer understanding of the diagnosis made and learn more about how to do the interpretation of the pictures.

Driving force

It has not been an easy task to get the inter-disciplinary collaboration through conferences to work in practice. There was an initial resistance to participate in the conferences when they were first introduced at four local hospitals. It was necessary to go through the hospital management in order to get a local contact person for the work. One hospital within the county is still not participating, and they neither refer patients with these specific diseases to Gastro Centrum. However, gradually the attitude has changed. After over a year of weekly conferences, most of the participants see the benefits. Today, there are eight (KOLLA) hospitals participating, and there are more to be included within the near future.

The driving force of getting these multi-disciplinary conferences to work in practice have been the specialist team assigned the task to develop the process and technology to be used within the process. They believed that this would be of benefit for all people included, not the least for the patient. This small kernel of dedicated people (cf. the driving force of communities of practice (Wenger 1997)) still exists. Today, the team consists of three of the four persons that were engaged from the beginning in 2003. The team have an interest in using technology for multi-disciplinary collaboration over distance, they are in the position to implement their ideas, and they have strongly believed that what they do is to the best for the patient. On-going information and scheduled invitations to

seminars have proved to be a facilitator to reach out to the other hospitals. Through such information and seminars, three remote hospitals (outside SLL) has on their own initiative asked to adhere to the network and bought the video-radiology system themselves.

One important part for success in the video-mediated conferences is the technology itself. Due to an initial resistance to participate in such conferences, it was decided that SLL should cover the expenses for the technology infrastructure, not the local hospitals themselves. Today, the technology for video-mediated conferences is installed at the radiologist unit within each hospital. The next step is to make it possible to attend the meetings from other places than the radiology unit, e.g., the at care unit.

The role of the technology

From a technology perspective it would be easy to say that the more bandwidth in the connection, the better conferences we could have. However, from an HCI-perspective, it is important to consider what effects the communication channels in the medium used have on the purpose. There are three communication channels used: video streaming from the different sites, voice from the different sites, and radiology pictures from Karolinska. It is obvious that the voice and radiology pictures are the most important communication channels.

The display for the video streaming from the sites is quite small. If there are many participants from a site, it can be difficult to see who is talking at the moment. However, the medical doctors are quite familiar with each other, and say that they, to some extent, can recognize people on their voice or on the video image. They also say that it may be difficult to recognize the person speaking if he or she is sitting in the back and if they are not familiar with this person. A better image of the person speaking has been suggested as an improvement in the communication in such situations.

We have also observed situations where there was a misunderstanding about the turn-taking during a discussion. One of the external sites started talking and Karolinska tried to interrupt because they wanted to say something before the external site started. The external site, however, did not hear that Karolinska wanted to say something, until after a few seconds. There were no problems in repairing the conversation, which makes it a minor incident. This shows that there might be a need to adjust/fine-tune/change the methods used when running the electronically mediated meetings. The same problem was mentioned in interviews. Jenny, a radiologist said

> The sound is the worst of it all. What is most disturbing is … you speak at the same time, it is as when you talk with USA on the phone, you need to calm down and let people finish. It is like some [people] start talking four or five times before they understand.

Participants in conferences have also reported technical problems with sound due to the sensitivity of the microphones. Minor noise in the room, e.g., someone coughing, a door being closed, a beeper, etc, becomes a large disturbance at the other sites. MORE

The technology today has a limit of connecting ten hospitals at the same time. However, interviews show that it is be difficult to have more than five hospitals connected at the same time due of interaction and communication problems among the participants. Bob, a senior surgeon, said during an interview:

It is fairly anonymous, you don't have time to see everybody and if someone comes in late, maybe you don't know everybody, it is easy that someone is forgotten. As the chair, you start with hello, who is here, and saying welcome to everybody. Now, most people know each other, but there might be someone sitting and then you have to let others know who you are and present yourself, if you don't do that, then it is a little anonymous. It is possible that this can be accomplished through being more clear in the communication, you must be that anyhow, speak clear and slow and turn to the person. It is not a big problem, but it is not optimal as it is now. The better the change of image is, the better the situation with the one you speak with is. The quicker you get change of sound, the better the communication gets. It is manageable today, but not very optimal.

The two of the radiologists interviewed, however, did not find it important to see who is talking at the moment, other than if a foreign language is used (in, e.g., an international collaboration). They also mentioned that it could be important to see pictures of the participants in order to know who is present. They neither saw any problems in limiting the number of hospitals connected to a conference, because usually there are only three persons involved in one patient.

The images of the radiology pictures are projected on larger displays. When asking two radiologists, Jenny and Paul, about what they think about how the participants are able follow what they show on the pictures they replied:

Jenny: it is not that much that they don't find it clear … I usually move it [the mouse] a little to make it

Paul: I guess they are use to it now, we have had the digital system in almost four years. They have learned how it works on ordinary rounds, so they know where to look. Some occasion they say "I can't see where you are pointing" and then you have to say "yes it is there up to the right".

We are presently working with the hypothesis that the use of video-mediated conferences within the multi-site network strengthens the feeling of belonging to the same team. MORE …

Conclusions

Diagnosing a patient … complicated disease … upper gastrointestinal tract … may involve judgements from several disciplines. A radiologist can, based on the X-rays, MR … understand the behaviour of a tumour. A transplantation surgeon … understands the conditions … if a transplantation is possible at all. An oncologist … understands how a cancer tumour would respond to … A pathologist … understand … The surgeon within the area of gastrointestinal tract diseases are the one that have the overall medical responsibility of the patient's treatment. He or she needs to understand all reasoning around the diagnosis made and how to give the patient the best possible treatment.

The quality and efficiency in getting a diagnosis and a decision of how to treat the patient is … the network based health care process in general and the video-mediated multi-disciplinary conferences in particular …

The multi-disciplinary discussions during the conferences fulfil several purposes. First, they provide a moment, when all competencies needed are gathered at the same time, to understand and reason around the diagnosis made. This moment gives the patient access to the best possible competence when deciding about the treatment. … Second, they provide a moment of rich and professional discussions, sharing of best practice and experience. … Third, they …

The technical infrastructure makes it possible to involve medical personnel and resources from local hospitals … Sound quality is important and may cause problem in an environment where mobiles and beepers need to be on all the time. Image quality is important to be able to follow the radiologist as he or she is communicating the diagnosis made based on the radiology pictures. The system was designed from the very beginning not to interfere with already existing equipment. During the installations at the referral hospitals, this was proven have succeeded because no modifications to local equipment was needed. Local equipment, such as the radiologists' workstation and existing video-projectors, continued to work as usual. The only new equipment was the touch-screen. All installations were made in collaboration with the radiologists and his or her local technical support manager (who is also the appointed local contact person for the system).

Acknowledgments

VR and all medical personnel involved ...

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