Computer Technology and Application 4 (2013) 431-436

Solve the Humanware Problem: Take the Full Advantage of Telemedicine

I.H. Monrad Aas

Division of Mental Health and Addiction, Vestfold Hospital Trust, Tonsberg 3103, Norway

Received: August 14, 2013 / Accepted: August 20, 2013 / Published: August 25, 2013.

Abstract: Telemedicine's greatest problem is not found in software and hardware. Many can make software and hardware work. It has for long been clear that telemedicine has diffusion problems. Focus should be shifted over to the humanware. Telemedicine means work is done by virtual organizations. For the future of telemedicine, organizational issues will represent a challenge. Organizations consist of humans in interaction. In Norwegian telemedicine projects, organizational problems were identified and solutions to the problems were designed. More than 40 publications show numerous organizational consequences and numerous types of organizational consequences. When it comes to the solving telemedicine's organizational problems, learning from the experience others have is important. It is not necessary for all to invent what the organizational problems are. Organizing health care around the physical telecommunication networks is associated with the concept of network organization. The electronic networks become an infrastructure around which single health care providers are distributed. Such network organization means a formation of alliances between organizations. Centralization and decentralization are important terms for all organizing. Telemedicine makes the question of centralization or decentralization relevant. Telemedicine requires collaboration between participating parties. Obtaining the benefits of telemedicine is dependent on implementing the right measures for good collaboration. We know there are problems with telemedicine virtual organizations, but solutions to these problems exist. For the future of telemedicine, doing work with organization is important. Skilled managers have an important role to play.

Key words: Telemedicine, virtual organization, network organization, centralization, decentralization, collaboration.

1. Introduction

Forecasting future developments is not necessarily easy. Many have failed, even failed about the future of concrete technologies. For telemedicine, an enthusiasm was built up in the 1990s. After a successful demonstration, it is easy to be enthusiastic about the technology. The champions for telemedicine were many and some seemed to believe in the death of distance. At the start of the new century it became clear that telemedicine had diffusion problems and problems with expansion of volume of use. Telemedicine did simply not spread like wildfire. For people with an interest in telemedicine, the question "what will the future of telemedicine be?" became natural. In the last years, we have seen a renewed interest for telemedicine. Telemedicine is done in more countries and in some countries the volume of use has increased (for example in the USA), but still we see problems with the diffusion of telemedicine.

Telemedicine has been viewed as a "technical fix" for the distance problem, but telemedicine's greatest problem is not found in software and hardware. Then, what about the humanware? Organizations consist of humans in interaction, and around the electronic networks of telemedicine organizations and humans must interact. Telemedicine means working by virtual organizations or virtual teams. The word virtual is of Latin origin and means thought or potential, but not in fact. Virtual organizations are "almost organizations" and members can work across space, organizational boundaries, and even time [1, 2]. A telemedicine

Corresponding author: I.H. Monrad Aas, Ph.D., senior researcher, research fields: health services research, telemedicine and psychiatry. E-mail: monrad.aas@siv.no.

virtual organization can be operative without a formal organizational hierarchy and chain of command. No doubt, virtual organizations are fundamentally different from the traditional organization. It is not right to conclude that when telemedicine is practiced only now and then, it is not a virtual organization.

Learning from the experience others have is important for the future of telemedicine. In two Norwegian telemedicine projects, organizational problems were identified and solutions to the problems were designed. The identification of organizational problems and design of solutions to these problems are important traits of this research. The more than 40 publications show numerous organizational consequences and numerous types of organizational consequences [1]. More than 25 studies from several countries confirm and corroborate the findings of Aas [3], for example Refs. [4, 5].

Aims are to show the fundamental role organizational problems of the telemedicine virtual organization and how they can be solved.

The paper is organized as follows: Section 2 states that telemedicine requires focus on organizational problems. Section 3 shows the relevance of network organization, centralization and decentralization, and uses teleradiology as a case. Section 4 goes a step further from teleradiology to other telemedicine applications. Section 5 shows solutions to the telemedicine collaboration problem. Section 6 is about other factors than those mentioned in preceding sections. Section 7 compares ordinary organizations and virtual organizations. Section 8 gives conclusions.

2. Telemedicine Requires Focus on Organizational Problems

It is a great misunderstanding to believe that telemedicine does not require focus on organizational measures. That an ordinary organization is found behind bricks and a telemedicine virtual organization is found behind clicks on a computer does not mean that a well functioning virtual organization is established without doing work with the organization itself. In the early days of telemedicine, champions of the technology did the work. When telemedicine is to become an ordinary activity, focus on the organizational problems is necessary. We have to deal with a number of organizational problems. There is no "deus ex machina" (God from the machine) coming to rescue the organizations. Organizations and humans in organizations must do the job and will be decisive for the future of telemedicine.

In the Norwegian studies, a similarity in organizational problems was demonstrated across organizations and even across very different applications, like teleconsultations and teleradiology [1]. Studies from other countries confirm and corroborate these findings [3]. The health service has different organization in different countries, but this does not dictate which organizational problems we find for telemedicine [3]. The telemedicine work itself has organizational consequences.

3. Networked Health Enterprises, Cybercorps, and Networked Regional Organization

How to organize telemedicine for the providers in an area or for the providers of a health care corporation is a problem. The solution is network organization and centralization/decentralization.

3.1 Network Organization

Network organization is not a new term, but well known from private industry, outside of the health service. The concept of organizing health care around electronic networks is associated with the concept of network organization. Tele-communications can be an infrastructure around which single health care providers are distributed. Such a network organization means a formation of alliances between organizations with purposes like: new distribution of hospital functions, increased flexibility in what single providers can do by competence complementation, shared investment in knowledge and human capital, improved

capability to exploit new forms of knowledge, promotion of learning, strengthening of professional communities, improved access to care and economies of scale [1]. We can speak about networked regional organization, networked health enterprises, or cybercorps. A cybercorp is a virtual organization comprised of a network of separate sites for production [1]. A new situation can be established with a complex combination of digital technology and new organization around the tele-communications 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.

3.2 Centralization and Decentralization

Centralization and decentralization are important terms for all organizing. 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 questions of centralization or decentralization relevant. Health institutions can be connected together with great capacity electronic networks. But, where should the different tasks be performed? In the telemedicine community, centralization of professional competence and decentralization of supply has often been mentioned.

Radiology can be used to illustrate the more general principle. The production process in radiology has two completely necessary elements, i.e. capturing of images and interpretation of images. Centralization can be defined as performing all, or parts, of the radiology image interpretation at fewer organizational units than before digitalization of radiology and teleradiology. An example is that a region centralizes image interpretation for one type of radiology to a larger radiology department. Decentralization can be defined as performing all, or parts, of the radiology image interpretation at more organizational units than before digitalization of radiology and teleradiology.

For radiology, we have a number of types of centralization. There are two extremes: (1) complete centralization is done with radiologists only at one hospital in an area covering all interpretation needs, and (2) no centralization, i.e. all hospitals have radiologists covering all interpretation needs of their own hospital. There are many relevant intermediate solutions. In the literature, a cross-table has been used to ease the overview Refs. [1, 2]. Centralization types are put in two main categories: geographic centralization (with three subcategories) and centralization according to function (with seven subcategories). The subcategories of geographic centralization can be combined with the subcategories of centralization according to function, and the cross-table has 21 (7 × 3) theoretically possible combinations [1, 2].

Teleradiology represents a possibility for building up centralized specialized competence. For sites, with few radiologists, having top competence in all areas of radiology is difficult. With teleradiology, existing specialized competence can be exploited better, more specialized competence can be developed, teams with specialized competence can be put together of persons who are not co-located, qualified second opinion and discussion of rare and difficult cases can be obtained more easily. The result may well be improved quality of image interpretations [1, 6]. Also, images from several sites can be stored in one common computer. Such archives can be used for pathology comparisons, to follow a patient’s history of disease, for learning and teaching purposes. The archives can play a role for quality [2]. With teleradiology, rethinking of the distribution of work tasks, for larger regions or in larger enterprises, is possible. Teleradiology enables a better exploitation of capacity for image interpretation. We can re-evaluate which location should perform which radiology with which workforce. Reconsidering the organization of 24 hours duties in-between hospitals, of a larger area or larger enterprise, it 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 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).

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 could drain small departments for radiologists. Fragmentation of care requires coordination. Many small organizations can be more difficult to coordinate for improved exploitation of total regional resources and measures needed to obtain good cooperation become more encompassing [1, 7]. Good information systems, with information available independent of location, will be required. Also, small organizations are more vulnerable, to for example sick leaves. Decentralization may still imply advantages like, capturing of radiology images in new locations (for example at islands and ski resorts). This can mean earlier diagnosis, earlier good quality care and the advantage of a shorter travel.

4. From Teleradiology Virtual Organization to Other Telemedicine Applications

Telemedicine has a number of other applications, for example telepsychiatry, teledermatology, telehomecare (virtual visits to the home and monitoring in the home), teleotolaryngology, teledialysis, wound care, postoperative care, endoscopic gastroenterology and rehabilitation. When it comes to the organization of telemedicine in geographic areas or in larger corporations, the radiology case is a useful model. Analysis of future organization of telemedicine, in general, can be based on network organization, centralization, and decentralization. For the full realization of the telemedicine potential, reorganization with network organization, centralization and decentralization is important. Application specific definitions for centralization and decentralization must then be made [1].

For a health service with extensive virtual organization, we can speak about a networked health sector. How well a network organization works can depend on the ability to coordinate the production process, the feeling of shared goals, skill and knowledge development. Managers must develop competence in what it means to manage a network. Network organization which has the potential to provide intangible benefits, like extension of employee networks and exchange of information about new developments, create broader knowledge, different and more experience.

5. The Telemedicine Collaboration Problem

Telemedicine requires collaboration between participating parties. Obtaining the benefits of telemedicine is dependent on implementing the right collaboration measures [2, 8, 9]. Collaboration measures can be defined as actions important for good telemedicine collaboration. When telemedicine is planned to be a routine activity, rather than just a project run by champions, implementation of measures of collaboration is required, not at least when a larger volume is planned [1].

Research has identified collaboration measures for telemedicine, both for teleconsultations (telepsychiatry, teledermatology, teleotolaryngology, telepathology frozen-section service) and teleradiology. For teleconsultations, 10 collaboration measures were identified and for teleradiology 17 collaboration measures [1]. Teleradiology and teleconsultations are pretty different forms of telemedicine, but we find obvious similarities (and differences) in measures for improved collaboration. Close to half of the collaboration measures for teleradiology and teleconsultations are either similar or have some similarity. The differences in collaboration measures can be due to differences in the nature of the work (teleradiology and teleconsultations are different work processes), and their synchronous and asynchronous

nature. 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), and telemedicine should be organized so participants get more experience with telemedicine (the collaboration works better when the volume is larger) [1].

6. Other Factors than Network Organization, Centralization/Decentralization and Collaboration Measures

Organizational self-interest is important and an obvious motivator for telemedicine participation. Management at different levels should involve itself in the inter-organizational collaboration, including top management. Managers close to the telemedicine activity may fear loss of power and control when employees work externally to own organization. Cross-professional working groups can decide procedures and guidelines for the telemedicine work. It can be necessary to perform a conscious selection of individuals and organizational partners. Participants must be motivated for telemedicine and the job to be done. Selection of organizational partners can be done on the basis of complementarity of resources, similarity in values and culture, and relative strength and size [1]. From research, organizational consequences of telemedicine internally in participating organizations are known to be very common [1, 10]. Changes in internal organization can be done together with implementation of collaboration measures.

7. Ordinary Organizations versus Virtual Organizations

In the early days of telemedicine, champions were doing the telemedicine work and the projects were many. With such a situation, it is easier to succeed. After the project period, no continuation of telemedicine has been seen time after time. Many have been disappointed and found it difficult to make telemedicine work.

However, this does not necessarily need to continue. Ordinary organizations are found behind bricks and virtual organizations behind clicks on a computer. If we have an empty building, move people into the building and nothing else is done, then we do not have an organization and clearly not a well functioning ordinary organization. Work must be done to have an organization and a well functioning organization. All understand that. Also, if we only click on a computer, we do not have a well functioning virtual organization. Work must be done to have a well functioning virtual organization. With the knowledge we have today all should understand that work must be done to have a well functioning telemedicine virtual organization.

8. Conclusions

There are problems with virtual organizations, but solutions to these problems exist. It is important to learn from the experience others have. Organizations planning telemedicine, as an ordinary activity rather than just a project run by champions, have a job to do. None of the problems with virtual organization and telemedicine collaboration are large enough to prevent effective collaboration. Skilled managers can tackle the problems, but it may be necessary to involve policy-formulating level. If health care tackles the situation correctly, organizations will not necessarily be the main future problem. Even, organizations can be changed to facilitators for telemedicine. 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. For the future of telemedicine, it is considered important that research includes investigations on collaboration for applications which are not treated here.

References

[1] I.H.M. Aas, The organizational challenge for health care from telemedicine and e-health [Online], The Work Research Institute, Oslo, Norway, 2007, pp. 1-11, http://www.afi.no/stream_file.asp?iEntityId=2088.

[2] I.H.M. Aas, Improving patient safety with telemedicine: Exploring organizational factors, in: A. Moumtzoglou and A. Kastania (Eds.), E-Health Technologies and Improving Patient Safety: Exploring Organizational Factors, Hershey, PA: IGI Global, 2013.

[3] I.H.M. Aas, Organisational consequences of telemedicine: Generalization of findings from Norwegian studies, in: Proceedings of E-Health and TeleMed 2011: Raising the Standard-Improving Care, Cutting Costs, London, 2011.

[4] C. May, R. Harrison, T. Finch, A. MacFarlane, F. Mair, P. Wallace, Understanding the normalization of telemedicine services through qualitative evaluation, J. Am Med Informatics Association 10 (6) (2003) 596-604.

[5] D. Nicolini, The work to make telemedicine work: A social and articulate view, Social Science & Medicine 62 (2006) 2754-67.

[6] I.H.M. Aas, Organizational centralization in radiology, Journal of Telemedicine and Telecare 12 (2006) 27-32.

[7] I.H.M. Aas, Organizational decentralization in radiology, Journal of Telemedicine and Telecare 12 (2006) 1-3.

[8] I.H.M. Aas, Telemedical work and co-operation, Journal of Telemedicine and Telecare 7 (2001) 212-218.

[9] I.H.M. Aas, Organizational cooperation in teleradiology, Journal of Telemedicine and Telecare 11 (2005) 45-50.

[10] I.H.M. Aas, A qualitative study of the organizational consequences of telemedicine, Journal of Telemedicine and Telecare 7 (2001) 18-26.