

Communication networks in different parts of a health system

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Networks: Abstract

Networks play a major role in modern communication today. A network is a complex system, consisting of Nodes and Edges. Nodes are the entities of the network system, having common properties. Edges are the links or connections between the nodes.

(Barabási & Oltvai, 2004; Boccaletti et al., 2006; Zhu et al., 2007; Csermely, 2009; Lovász, 2012)

In understanding the architecture of a network, we have to evaluate its characteristics, the different parts making up a network and the internal connections within it, i.e. how many connections each node has. If a node serves a higher number of connections than the average, it may be defined as a hub. An error, or an attack of a hub, may therefore lead to a breakdown in a network system. This is a concept important i.e. using hubs as a drug target in therapy (Albert et al., 2000). It can also show the vulnerability of the use of technological systems in the hospital networks in which I will explain further in this essay. If anyone hacks or makes an error somewhere in the system, it may have significant consequences for the entire network and eventually can cause a cascading failure of a network. Hence, knowledge regarding a network's topology is essential for evaluating the vulnerability of a network, potential risks and threats to the system. For this paper's purpose with focus on patient safety and prevention of information leaks.

(Albert-László Barabási, Network Science,

<http://networksciencebook.com/chapter/8#attack-tolerance>,

<http://networksciencebook.com/chapter/8#cascading>,

<http://networksciencebook.com/chapter/1#vulnerability>)

In this paper, I will investigate the communication networks within different parts of today's health care system.

The three different parts of the system I will focus on are networks between partner hospitals, between the physician and patient, and finally the networks between patients.

How do the patient, the physician and the hospital benefit from communication networks in today's health care system? What are the challenges, drawbacks and risks with these networks?

Networks between hospitals:

National EHR-system

As the technology develops, communication networks between different departments internally in a hospital and also communication between different hospitals regionally regarding a patient is expanding. The establishment of a nation-wide electronic health record system ensures a more efficient way of getting access to and sharing essential information about a patient. It is beneficial for the health care workers as it may promote health and lead to a better decision regarding preventive therapy, treatment and also follow-ups of a patient.

However, there is a risk regarding leaks of sensitive patient information such as electronic health records (EHR, in which jeopardizes the patient safety. In an article from Japan, the authors suggest methods for solving the problematics around electronic health record sharing and access to information. Among them, is a privacy policy, where the patient can access and declare a list of hospitals that can access his/her health records and clinical information.

(Naoto Kumea, Shinji Kobayashia, Kenji Arakib, Hiroyuki Yoshiharaa, Department of Electronic Health Records, Kyoto University, Kyoto-city, Kyoto, Japan, Department of Medical Informatics, University of Miyazaki Hospital, Miyazaki-city, Miyazaki, Japan)

<https://www.ncbi.nlm.nih.gov/pubmed/29295388>

<http://ebooks.iospress.nl/publication/48441>

Skype-meetings

Another network system between different departments of partner hospitals I experienced during this year summer practice. I worked in the Department of Cardiology at Oslo University Hospital. Every afternoon, they arranged interactive “Heart meetings”, using Skype, with the other Cardiology departments in the country. At one electronic screen they had the other cardiology team, on the other screen, both teams shared the clinical information regarding the patient to be discussed, such as medical imaging, lab values, ECG’s etc. The cardiologists discussed the case and further treatment plan. On each team, there was also Thoracic surgeons present, which rejected or accepted the patients for surgery. If the teams, after collectively discussing the case, decided to transfer the patient between hospitals, they organized the transport with the Norwegian Air Ambulance Foundation and the patient was already transferred within the next hours.

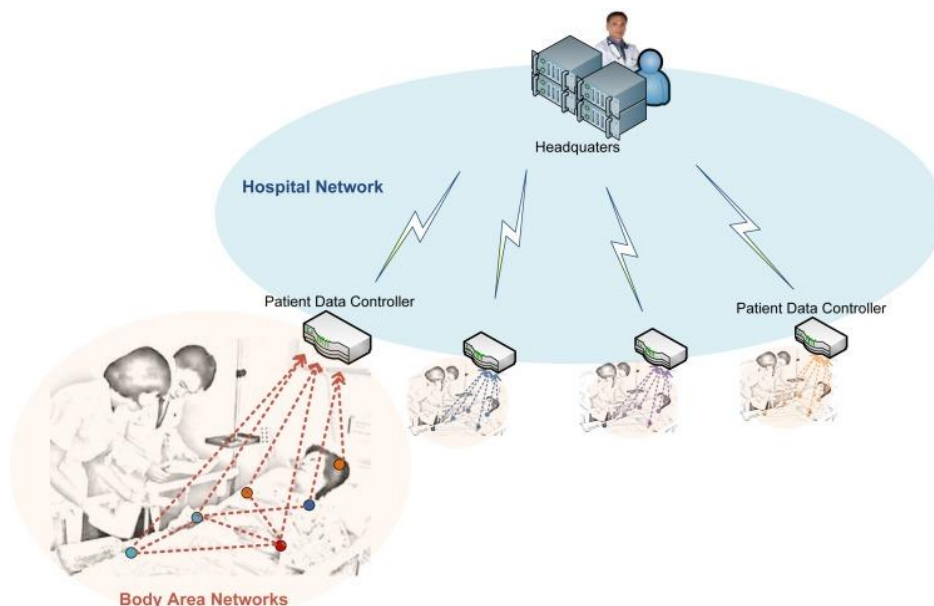


Illustration of a Hospital Network Architecture, where the information and records are collected and further distributed in a data-base in which can be accessed by declared parts

of the Hospital network. This illustrates how information is shared between two different networks; Body area networks and Hospital networks. In addition, within the hospital networks, the information is shared between the regional hospitals, the departments and the patient itself.

(Danielle Bragg,¹ Mira Yun, PhD,² Haya Bragg,³ and Hyeong-Ah Choi, PhD³,
Princeton University, Princeton, NJ, USA.)¹ Princeton University, Princeton, NJ;
<https://www.ncbi.nlm.nih.gov/pubmed/23304390>)

Patient-physician networks

E-consultation

E-consultation is a new and alternative way to provide health care services to the patient. It serves as a way to expand the availability and capacity of doctor-patient communication. The benefits of this type of network is that the patient can receive medical advices from a doctor, independent on their location. It may also serve a way to get medical help immediately, in which the patient communicates by writing a short summary of their issue. The doctor can easily answer their medical questions and give further advices. This is a time-sparing solution for both the doctor and the patient and may decrease the waiting time significantly.

The e-consultation is a suitable alternative appropriate for small medical issues such as renewal of prescriptions, non-acute medical help and advices regarding dosages of medicines.

However, this type of networks has its limitations, such as when the medical issue is more complex, severe or acute, which rather indicates the traditional face-to-face consultation.

(Li J¹, Liu M¹, Liu X¹, Ma L¹, School of Business, East China University of Science and Technology, Shanghai, China, <https://www.ncbi.nlm.nih.gov/pubmed/28686084>)

There are various suggestions to how we can improve the e-consultations limitations. I.e. in the mentioned example above, a “modified” variant of the e-consultation – a video-consultation may be a good option. This provides a real-time visual aspect as well, making it easier to provide the necessary medical help. Examples of appropriate issues can be may be

throat and eye infections, allergy, rashes, insect bites etc.

A British study piloted an e-consultation system for 15 months across six general practices. The purpose was to see if the system actually promoted efficiency and benefits for both the physicians and patients. The study concluded that there were fewer benefits for the practices, as most of the e-consultations needed to be followed up by phone or face-to-face appointments due to insufficient information for the clinical decision to be made.

(Jon Banks, Michelle Farr, Chris Salisbury, Elly Bernard, Kate Northstone, Hannah Edwards and Jeremy Horwood, <https://bjgp.org/content/68/666/e1>)

Patient-patient networks: social media and forums

World wide web

The World Wide Web is the largest network ever built. It allows us to easily collect information, discuss and communicate with people among the entire world regardless of time and location. It is a great tool to extend our knowledge and scientific interest in an easy and effective way.

WWW is a scale-free network, meaning that no internal scale is present, due to having nodes with widely different degrees in the same network, contrary to networks with all nodes have the same degree or vary in a narrow range, such as seen in lattices and random networks respectively. (Albert-Làszló Barabási, Network Science, The Scale-free Property <http://networksciencebook.com/chapter/4#scale-free>)

However, the world wide web may also be a source of misleading information.

In a patient-patient network point of view, the use of social media and forums on the internet for self-education and discussion regarding a disease has dramatically increased over the last years. Patients may discuss their symptoms with other people and seek medical advices from other people that do not necessarily have sufficient medical knowledge. This is potentially challenging or even threatening both to the patient them self, and to the confidence of the physician treating their condition.

(De Martino I1, D'Apolito R2, McLawhorn AS2, Fehring KA3, Sculco PK2, Gasparini G4. <https://www.ncbi.nlm.nih.gov/pubmed/28110391>)

I also want to bring another example from the hospital summer practice, showing how social media may jeopardize patient safety. The department had by a few cases experienced that transplant patients receiving an organ, only a few days after the transplant, published photos or messages telling that they did great after the transplant and were soon ready to leave the hospital. This was a huge threat to patient safety and confidentiality, as Facebook with its 2 billion monthly active users, is the most used social network on the web.

(<https://newsroom.fb.com/company-info/>) Especially in a small country as Norway, there is a significant risk that someone, ie. the donor's family recognizes the time of transplant and age of receiver. This case made me really think of the dangers of such a social network in spreading information that should be held confidential.

Conclusion

The communication networks in today's health care system potentiates both beneficial and disadvantageous aspects. The network building is tremendously expanding and still has a huge potential to grow even bigger. But we still need to keep the limitations and possible threats of these networks in mind. Also, as the networks are changing every day, (Péter Csermely, Weak links, Social nets, Springer Verlag, Heidelberg, Germany <http://linkgroup.semmelweis.hu/docs/08-social-nets.pdf>), we need to develop further methods for securing the patients safety, increase efficacy and functionality and promote the benefits of these networks to be able to rely on them.