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Telemedicine: advances in high-tech healthcare

Increasing average longevity, the growing number of chronic diseases and health economy issues are all generating an ever-increasing demand for inexpensive therapy options that are not time- or location dependent. For the past 10 years or so, telemedicine has been offering advanced solutions for a broad range of medical and health issues. Despite this progress, the use of telecommunication and information technologies in the provision of remote healthcare services appears to be stagnating.

There are many ways of using telemedicine but it can be roughly divided into the two areas: "doc2doc" and "doc2patient". "doc2doc" is the transmission of patient data from one doctor to another in order to obtain a second opinion on a patient's health status and recommended treatment; it is also used to exchange knowledge and for the further education and training of medical professionals. For example, Tübingen's Sectio chirurgica (TSC) at the University Hospital in Tübingen uses telemedicine tools for the further education and training of surgeons; telemedicine tools are also routinely used by stroke networks and by numerous general emergency healthcare centres to transmit vital parameters (ECG, blood pressure, breathing, movement) to medical specialists who are able to give immediate instructions to emergency personnel or set up further treatment.

Direct cooperation between doctors and patients, "doc2patient" telemedicine, enables the monitoring of health parameters as part of rehabilitative or preventive therapy, as well as remote diagnoses and the setting up of therapies if required or adjusting the dose of medication. Patients themselves carry out regular monitoring of their vital values by operating the measurement devices and following agreed schedules for collecting and transmitting the required data. Patients have a special device for remaining in contact with a telemedicine centre that analyses their data and passes them on to medical experts or healthcare personnel in case of emergency.

Patient taking his blood pressure.
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The basic concept of telemedicine encompasses methods for electronically transmitting medically relevant information, thereby creating an early-warning system that enables a quick, adequate response, particularly in emergency situations. As a complement to specific health checks in clinics or GP practices, telemedicine solutions improve the quality of data for diagnosis and treatment through the continuous collection and transmission of day-to-day patient data. As such, telemedicine expands on rather than competes with conventional treatment structures, and can actually improve the quality of patient care.

Mobile measurement devices, smart textiles and health apps

Patient data are transmitted to a telemedicine control centre using mobile measurement devices with electronic exchange capabilities. Depending on the quantity of data required for monitoring a particular patient's health status, these devices are either used at specific intervals or permanently worn on the body. The easy handling of the measurement devices helps the patient to maintain a regular schedule of checks. The devices have the additional advantage of keeping doctors informed about their patients' health status outside of traditional face-to-face consultations, which continue to take place at specified intervals.

Mobile phones – self-management tools for the patients to observe and communicate their own health status.

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Smart textiles can be used for monitoring skin temperature, heartbeat and breathing rate of firefighters, to name but one example of their application. Smart textiles are equipped with sensors that record vital parameters and radio-transmit them to a central unit. As the sensors are integrated into clothing, no extra time needs to be spent recording and transmitting the data. This is crucial in emergency situations where every second

counts. The development of smart textiles is currently in the experimental stage and only used in a handful of instances.

Hundreds of so-called health apps are available for smart phones and users can download applications and use them without medical assistance. Many of these apps are merely informative or designed to accompany the user in certain situations such as pregnancy and diet or facilitate the storage of personal data in chronic diseases such as diabetes or high blood pressure. People suffering from allergies can download allergy alert apps on pollen dispersal; apps to help choose restaurants can be downloaded by people suffering from food intolerance. The German Red Cross' "MeinDRK" app for medical emergencies contains helpful first-aid information, and is one of the many other health apps available. Most apps are destined for private use and provide assistance with chronic diseases or emergency situations; they are not usually connected to a telemedicine system.

The establishment of a telematics infrastructure is a prerequisite for regional provision of telemedicine services

Telematics is the integrated use of telecommunication systems and informatics and is applied, for example, to sending, receiving and storing patient information. A comprehensive telematics healthcare infrastructure on the regional, national and international level is important for an effective telemedical system. However, the transmission of patient data in emergencies, to name but one example, is associated with data protection challenges, which are currently slowing down the area-wide implementation of telemedical networks and hence the use of telemedicine in everyday patient care.

Schematic showing the transmission of data in the telemedical project "Partnership for the Heart"

© Partnership for the Heart

One of the first milestones towards establishing an effective telematics infrastructure will be the provision of electronic health cards (e-card) to all insured people in Germany. This e-card will link patients to various healthcare providers by means of telematics. An issue that still needs to be resolved before an effective telematics infrastructure can be established in Germany is finding a way to legally secure the administration of the master records of all insured people as well as defining an emergency dataset that can be stored on the e-card. The emergency dataset will include information on diagnoses and medication, pregnancies, drug allergies and other data crucial in an emergency. The e-card needs to be quick to read and personal information must be protected by encryption. The establishment of comprehensive telemedical services is a complex challenge that can only be resolved on the condition that all systems and partners are able to communicate well with each other. "The systems need to understand each other, it is not enough just to connect individual networks, projects and systems up with each other," says Sebastian Claudius Semler, managing director of TMF – Technology, Methods and Infrastructure for Networked Medical Research, the umbrella organisation for networked medical research in Germany. "It is our mission to overcome the intellectual and technical divide between patient healthcare infrastructures and medical research," says Semler.

Government supports expansion of telemedical healthcare

The German government directly supports the establishment of a telematics infrastructure and the advancement of telemedical applications with the eventual aim of guaranteeing the nation-wide provision of healthcare services in the long-term. The German eHealth Initiative launched by the Federal Ministry of Health and united key players in the German healthcare system has led to the establishment of the German Telemedicine Portal, which was developed and is maintained by the Fraunhofer Institute FOKUS (Fraunhofer Institute for Open Communication Systems). The portal offers information about telemedical services and projects with the aim of facilitating new collaborations and improving the transfer of telemedicine projects into standard care.

Besides the technical, legal and organisational hurdles telemedicine has to overcome, achieving broad acceptance among the general public is the final and potentially also largest hurdle on the way to becoming a standard care practice. The recognition of the services as a health insurance standard and acceptance of new telemedical methods and technical devices by patients and GPs are urgent issues that need to be dealt with. The R&D project "Partnership for the Heart" brings together project partners from research, applied medicine, industry, telecommunication and healthcare and thus demonstrates how telemedicine can work on a broad basis.

Diana Schwarz - 12.08.2013
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