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TeleCardiology: Results of a Highly Successful Service in The Netherlands



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Telemedicine

Telemedicine is the delivery of healthcare and sharing of medical knowledge by use of information and communication technology (ICT), enabling caregivers and caretakers to work together independently of place and time for the purpose of consultation, examinations or medical procedures, and education (Strode et al. 1999). Telemedicine has been considered an organisational answer to keeping healthcare accessible for the general population. It has become one of the solutions for the restructuring of healthcare systems in the developed world and the progression towards better healthcare in developing countries in coming decades.

Due to its visual character, dermatology was one of the first specialties to adopt telemedicine, preferably in store-and-forward sessions (Wurm et al. 2008). Telemedicine has also been widely introduced in other specialisms like cardiology, ophthalmology and pulmonology (Hailey et al. 2004; Lamminen et al. 2003; Thrall 2007).

Telecardiology, the application of telemedicine in the field of cardiology, has applications in diagnosis and management of hypertension, implantable electronic devices, echocardiology and coronary CT scans, reduction of sudden cardiac death, diagnosing acute ST elevation myocardial infarction, the treatment of heart failure and diagnosis and treatment of arrhythmias. Studies have shown telecardiology services to substantially reduce the number of hospitalisations of patients with a wide range of heart diseases and conditions, and to lower mortality after myocardial infarction, compared to the general acute myocardial infarction population (Birati and Roth 2011).

Teledermatology has been fully integrated in the Netherlands and has been extensively described (van der Heijden et al. 2011). Comparable results to teledermatology are reached in telecardiology.

This paper describes results regarding implementation, efficiency and quality of telecardiology in regular care, performed by GPs and medical specialists that work with KSYOS TeleMedical Centre, an institution for specialist medical care engaged in developing, researching and introducing telemedicine services in regular healthcare.

Health Management Research Model

With the use of the Health Management Research Model (Witkamp and van der Heijden 2012), private and public parties and independent knowledge institutes can jointly develop telemedicine tools, study their effect on efficiency increase of the primary healthcare process, and enable their modular introduction and upscaling in regular care through 4 phases (see Table 1). It entails usability, feasibility, efficacy and (cost-)efficiency research aimed at professionalising new telemedicine tools in a phased way, obtaining support, proving the effect on the improvement of efficiency, and after that studying the user and reimbursement model. Independent scientific parties protocol the various stages of the research and monitor its quality and independence.

Telemedicine Development (phase 1 and 2)

Partners construct a telemedicine tool and develop it to an integrated service that incorporates most aspects of ICT security, safety, software, hardware, hosting, infrastructure, logistics and, if needed, certification.

| | |
|---------|---|
| Phase 1 | A specific Telemedicine service is developed, which is tested internally for usability in practice. |
| Phase 2 | 10 to 20 future users test this Telemedicine service for usability in practice. |
| Phase 3 | 50 to 100 future users test whether the Telemedicine service actually contributes to improved efficiency in the healthcare process: a higher production volume and/or better quality at lower or the same costs. |
| Phase 4 | Many users in a full implementation of the Telemedicine service generate data in real life experiment. These are used to investigate large scale cost efficiency. Results can be used in developing sustainable business cases. |

Table 1. Health Management Research Model phases

Health Management Research (phase 3)

Health Management Research aims to prove that the use of telemedicine services increases efficiency on several levels: bringing more work satisfaction at the user level, increasing production volume and providing better healthcare quality at equal or lower costs.

Health Management Implementation (phase 4)

All stakeholders – manufacturers, users, policymakers and health insurers – are involved in the design of practice and reimbursement research. The starting points here are significant reductions in costs on a macro level and a sustainable business case, with surplus reimbursement per use for manufacturers, users and policymakers. The interested parties together establish a price for the use of the telemedicine tool, and predefine performance indicators that are conditional for reimbursement. These performance indicators may entail health outcomes as well as logistic outcomes. In order to guarantee successful upscaling in regular care, the benefits of the telemedicine instrument for, and its synergy with, regular care are actively marketed and communicated.

KSYOS TeleMedical Centre: the First Virtual Hospital in The Netherlands

Safe, prosperous and socioeconomic balanced introduction of telemedicine services demands its provision by certified centres that meet minimal quality requirements: a care institution (or commercial company) that acts as a dedicated telemedicine provider, thus providing a single organisation that manages all these issues and is also the point of contact for patients, care professionals and other actors such as government and supervisory bodies. The responsibilities and tasks that a telemedicine provider can (and perhaps should) incorporate to set up a telemedicine service are:

- Administration, registration and storage of clinical records;
- Negotiating sustainable reimbursement with healthcare insurers;
- Handling claims and crediting incorrect claims;
- Payment of involved actors (eg dermatologist, general practitioner (gP) and telemedicine provider staff);
- Providing clinical liability insurance specifically tailored to telemedicine procedures;
- Providing a telemedicine software platform and keeping it up-to-date in concordance with the latest security standards, legislation and regulations;
- Providing suitable hardware for telemedicine procedures (eg ECG recorders, cameras, dermoscopes);
- Providing CME-accredited training programmes for the medical staff (eg taking clinical pictures, using the telemedicine platform, assessment of skin lesions via telemedicine);
- Providing on-site training in the use of the telemedicine system to all users;
- Providing project management for telemedicine implementation in a region;
- Providing a helpdesk service for technical and administrative issues;
- Providing yearly reports on performance indicators (eg per clinic);
- Providing integration with Electronic Health Records (EHRs) for both gPs and specialists;
- Negotiating and developing communications standards together with EHR providers and other (governmental) actors;
- Adhering to the latest quality standards and certifications where and when applicable (eg ISO, CE).

KSYOS TeleMedical Centre was officially recognised as a healthcare organisation in December 2005. KSYOS contracts health insurance companies and care groups that pay for each tele-examination and teleconsultation that is performed. KSYOS in return provides a complete service integrating all the items mentioned above.

TeleCardiology Results in The Netherlands

Process

KSYOS Telecardiology consists of two types of diagnostic tele-examinations (TeleCardiology Rest ECG (TCER) and TeleCardiology Event ECG (TCEE)) and teleconsultations (TCC) with the regional cardiologist.

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Depending on the clinical context, a gP can give patients a TCER on the spot, or the gP can provide a recorder and the cardiac rhythm can be recorded continuously for 24, 48 or 72 hours, or even up to 7 days or 14 days in a TCEE. Unlike conventional event diagnostics, the advantage of continuous recording is that asymptomatic clinically relevant arrhythmias are indeed registered (for example, paroxysmal atrial fibrillation).

All ECGs (biometry) are stored as a PDF file. This PDF can be accessed online through the secured online KSYOS Electronic Patient Record and are assessed by a grader. This can be a cardiologist but also analysts trained specifically for this task. The results (biometry and grading) are presented to the gP who ordered the tele-examination.

If an abnormality is found, the gP can decide to refer the patient physically, or send a TCC to the regional cardiologist using the data received from the teleexamination, all from within the KSYOS Electronic Patient Record. Additionally, the system selects about 10% of the teleexaminations at random for auditing, where a cardiologist reviews the quality of the biometry and grading anonymously. The biometrist and grader thus receive feedback on their work.

TeleCardiology Examination

Since May 2011, KSYOS has performed 14,687 TCERs and since August 2013 2,195 TCEEs together with 557 gPs. 14% and 43% of TCERs and TCEEs respectively were converted to a telecardiology consultation.

TeleCardiology Consultation

Since 2006 there have been 170,189 teleconsultations performed through KSYOS, of which the most used services are teledermatology (TDC) (111,597), telecardiology (TCC) (24,924) and tele-ophthalmology (TOC) (18,646). These teleconsultations were sent and answered by 884 gPs and 256 cardiologists in TCC, 1,003 gPs and 98 ophthalmologists in TOC and 3,232 gPs and 348 dermatologists in TDC.

Reduction of Physical Referrals

In 46% of all TCCs (n=11,483), the gP intended to refer the patient physically to the cardiologist if teleconsultations were not available. In this group, 59% of the patients (n=6,736) were not physically referred after TCC.

Quality of Care

In total 13,441 patients (54% of all TCCs) were selected for advice via TCC only. In this group, 2,579 patients were referred to the cardiologist as a result of early diagnosis in the TCC. These additional referrals lowered the overall reduction of physical referrals from 59% to 36%.

The mean interval for answering by the cardiologist was 5.4 working hours. The gPs indicated in 80% of all TCCs that the answer of the cardiologist was useful. In 70% of all TCCs, the gP perceived a learning effect from TCC (see Figure 2).



Figure 1. The TeleCardiology Process

| | male | female | avg. age | median age | max age | min age |
|-------------------|------|--------|----------|------------|---------|---------|
| TeleDermatology | 44% | 56% | 44 | 45 | 104 | 6 days |
| TeleCardiology | 50% | 50% | 59 | 61 | 111 | 2 |
| TeleOphthalmology | 51% | 49% | 66 | 68 | 110 | 1 |

Table 2. Teleconsultation Demographics

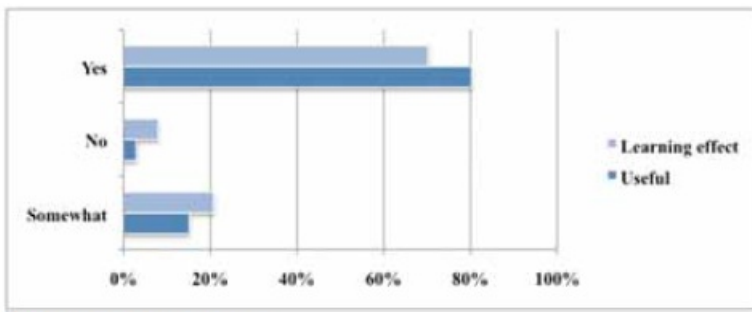


Figure 2. Perceived Learning Effect

With advances of technological medical possibilities and the ageing and more demanding population, healthcare organisation and delivery need to undergo drastic changes. At regional, national and international level, health workers, policymakers and health insurance organisations are addressing these issues. Efficiency increase of healthcare delivery and the role of ICT in this process is a recurrent issue in policy documents and grant descriptions. Instead of piling on new telemedicine services on top of existing conventional healthcare services, at the base of this efficiency increase is the replacing of the bulk of the work from higher to lower in the health knowledge hierarchy – from medical specialist to general practitioner, from general practitioner to nurse practitioners or from nurse practitioner to the patient – under supervision of the person higher in the hierarchy.

Telemedicine is perceived as an excellent tool to achieve this goal, combining innovative technology, changed working conditions, prevention and education. With the use of telemedicine, conventional general hospitals are able to elaborate on their role as a centre of excellence on the top of the knowledge hierarchy in healthcare. On the one hand, it enables these hospitals to further focus on highly specialised care as with the help of telemedicine less routine care will pass through their doors. On the other hand, telemedicine enables these hospitals to maintain their supervising role in this routine care.

Apart from the fact that telemedicine in general prepares hospitals for future changes in healthcare delivery, telecardiology has proved to have various immediate positive effects.

The results of this evaluative study show that KSYOS TeleCardiology Consultation leads to a 59% reduction of physical referrals in the group that the gP intends to refer physically to the cardiologist. The overall reduction rate was lower (36%) because of TCs for advice that led to additional referrals occasionally.

Teleconsultation leads to quality increase as a vast proportion of all TCs are performed for advice only (54%) and without intending to refer physically. In addition to that, some TCs for advice are leading to a physical referral (19%). Both parameters can be seen as quality improvement. Without telecardiology these patients would have had no supervision by or referral to the cardiologist. The response time of 5.4 working hours is in sharp contrast to usual waiting times of 4 – 6 weeks for physical referrals. Finally, the learning effect of TC will in the long term lead to better care, as all healthcare providers down the hierarchy chain are learning through using telemedicine.

Telecardiology enables hospitals and cardiologists to influence their waiting lists. By doing so, the hospital delivers quicker and better care to general practitioners and patients without cannibalising on their own production. If telecardiology is delivered on a regional basis, general practitioners and cardiologists are excited about telecardiology. Telecardiology strengthens the health chain and contacts between general practitioners and cardiologists. Offering telecardiology, the hospital firmly strengthens and enlarges its catchment area of general practitioners that refer to it.

Key Points

- Using the Health Management Research Model, private and public parties and independent knowledge institutes can jointly develop telemedicine tools.
- Safe, prosperous and socioeconomic balanced introduction of telemedicine services demands its provision by certified centres that meet minimal quality requirements.
- In this study 59% of the patients the GP intended to refer were not physically referred after teleconsultation.
- Telecardiology enables hospitals to deliver quicker and better care to general practitioners and patients without cannibalising their own production.

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