

# Next generation of telemedicine – at scale at last!

Often telemedicine and remote management of chronic diseases are only applied in small scale and are not an integral part of daily practise. Hence the Danish government, municipalities and regions in 2012 acceded to a national action plan with the goal of implementing telemedicine at a larger scale and in daily practise.

## The first steps

One of the results of the plan is the adoption of telemedical assessment of ulcers accomplished in 2015 as the first nation-wide telemedical project in Denmark ever. By using telemedicine, municipal home care nurses together with specialists at the hospital have been able to treat patients with ulcers in their homes and with greater patient satisfaction. Another result was the first national elements in a coherent IT-architecture for telemedicine.

## Ambitious new national agenda

Following the action plan from 2012 a nation-wide plan for implementing telemedicine in new areas before 2020 has now been agreed upon. Some of the most important elements in the plan are: 1) Offering telemedicine for patients with chronic obstructive lung disease (COPD), 2) Tele-patient-reported outcome (telePRO) implicating that patients report on their symptoms and provide a status on their health in questionnaires completed by the patients at home. The information is used to decide whether a patient needs an outpatient visit or the visit may be postponed and 3) supplementing the IT-infrastructure for telemedicine with more reusable national IT-services and governance of an open source ecosystem by The Foundation for Software-based Health Services (4S; <http://4s-online.dk>).



Home monitoring of patients with COPD focuses on improving patient safety, empowering the patients, lowering the number of readmissions to hospitals and preventing exacerbations. ©Colourbox.dk.

### Telemedicine

In Denmark telemedicine and telehealth are considered to be interchangeable terms. Telemedicine is defined as health-care services delivered at a distance by using information and communication technology thus making the patient and health care professional independent of a physical meeting.

## Cross-sectorial effort for patients with COPD

The ambitious vision of providing a nation-wide offer of home monitoring for patients with COPD is intended to bring higher quality and flexibility in treatment, better patient safety, improved patient empowerment as well as a higher health-related quality of life.

Patients suffering from COPD often draw on health care services across the different sectors. Also, they are known to have difficulties in recognising the onset of an exacerbation and subsequent delay in initiating treatment in time. The result is undesirable fall backs and admission at the hospital, thus patients with COPD account for a high burden in healthcare services overall.

In addition the offer is intended to reduce the number of readmissions and unnecessary outpatient visits at hospitals. This large scale implementation will be based on experiences from several projects carried out across the country.

To be able to achieve the vision hospitals, municipalities and general practitioners (GP) are obliged to find new ways of co-operating with the patient across sectors and customize their working procedures to the use of telemedicine.

### Public health care in Denmark

In Denmark there is a universal coverage (same system for everyone) and free and equal access to public healthcare. Central Denmark Region is one of the five Danish Regions responsible for the greater part of public health service in Denmark. The regions' primary tasks are the operation of hospitals, general practitioners and practising specialists. The 98 municipalities in Denmark are responsible for homecare, nursing homes, rehabilitation and prevention. To ensure a coherent public health care system co-ordination and agreements between regions and municipalities are mandatory according to The Danish Health Care Act of 2007.

## Implementing telePRO

Based on experiences from Central Denmark Region (CDR) the Danish Government and Danish Regions have agreed upon implementing telePRO to patients suffering from epilepsy, prostate cancer, and patients with cancer receiving chemotherapy.

Lifelong follow-up for patients with chronic diseases is traditionally managed by regular pre-scheduled visits. These visits may occur when the patient is well, and neither the patient nor the clinician finds the visit necessary. When using telePRO outpatients report their symptoms and health status via questionnaires answered while the patient is at home before or instead of visiting the outpatient clinic. Based on the patients reporting the telePRO assessment can be used to avoid unnecessary outpatient visits placing an increasing burden on both patients and on an overstretched public health care service.

### Tele-PRO

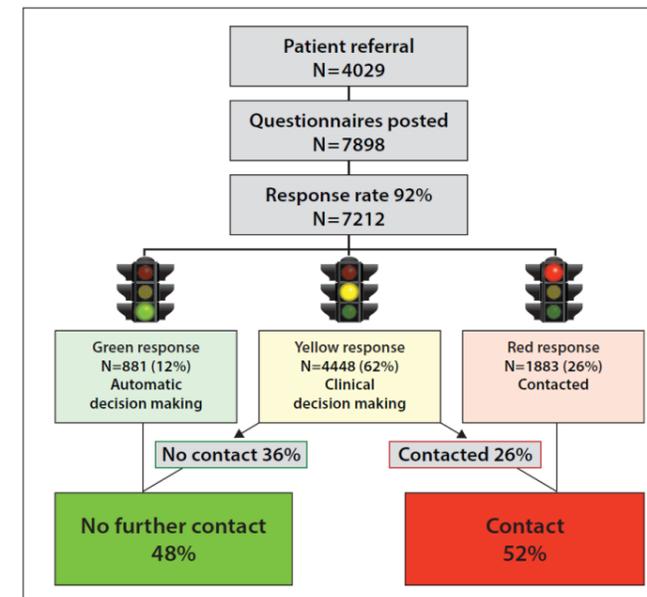
The Tele-PRO system used in CDR consists of three generic elements: PRO data collection, PRO-based automated decision algorithm and PRO-based graphical overview for clinical decision support. The system is used by more than 16,000 patients in CDR alone and for 13 different patient groups.

## Reducing outpatients visits by 48%

In CDR experiences over the last 3 years have shown that close to every second outpatient visit for patients with epilepsy is unnecessary and can be substituted by telePRO. Consequently, the daily working procedures have changed during the roll-out of the system. Based on a graphical overview of the patients answers nurses assess whether to contact the patient for further information, schedule a consultation for an outpatient visit or given that everything is all right, to schedule an appointment for a new questionnaire.

The patients experience more flexibility, increased knowledge of their own disease and symptoms as well as a more patient-centered care. Also the staff is satisfied using telePRO as it allows them to be well prepared prior to outpatient visits and focus on complex patient needs as opposed to using time on routine visits.

### Tele-PRO



Tele-Patient Reported Outcome in Central Denmark Region reduces the number of face-to-face consultations for outpatients with epilepsy by 48%.

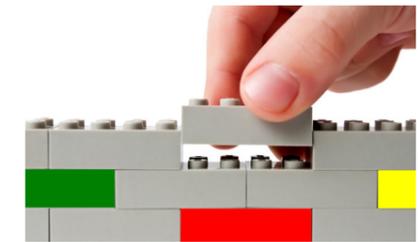
## IT-infrastructure for telemedicine

The past couple of years have shown that the barriers for a wide-spread adoption of telemedicine is not merely a question of financial and professional challenges but perhaps most of all a lack of a fundamental IT-infrastructure and too many monolith, stand-alone solutions. A prerequisite to move telemedical applications from pilot stage to routine delivery at scale is to provide an IT-infrastructure, allowing a safe and legal transfer of health data across sectors and a shift from monolith to module based solutions.

## Modular structure based on open source

The national eHealth Authority and Danish Regions have committed to enhance and apply a modular IT-infrastructure for telemedicine. The new infrastructure will consist of services or modules, which are easily built together. Each module solves a small task and all modules fit together and compose a larger picture.

The modules follow international standards and will be thoroughly tested and documented. This will make it easier for companies developing medical equipment to integrate the different services in their products.



An IT-infrastructure for telemedicine organised in modules that are easily built together.

To understand the importance of the concept of using modules, compare the process of building a model of a plane in wood or steel with the process of constructing it using LEGO®: once the LEGO bricks are developed, it is much easier and faster to build the model in LEGO, and more importantly, it is much faster to make changes, corrections, adaptations, and updates to the design.

## Advantages of using modules

- It is easier to handle changes in small modules than in the entire system and modules may be re-used.
- Over time software "rusts" – i.e. becomes outdated or becomes incompatible with new systems. With a modularized system, continually exchanging the rusty parts with new parts keeps the system up-to-date.
- Some functions may be more critical than others, for instance software assisting in clinical decision-making would be more critical than the software painting graphical elements on the screen. The critical software parts require a lot more testing as well as a meticulous development process. As these software parts are isolated in dedicated modules, the time-consuming processes will apply only to these modules rather than to all the software.
- Infrastructure and data-interchange modules are designed with data integrity and data confidentiality in mind. By doing this a vendor can build applications that more easily can be adopted into an environment where regulations in respect of handling personal data is very strict.

## What does the future bring?

The next four years will provide important knowledge on how to succeed with nation-wide implementation of telemedicine supporting a more patient centred, coherent and efficient public healthcare.

According to our comprehensive experience in the field of telemedicine, we have found that it is of utmost importance to combine the use of technology with new working procedures. Furthermore, establishing a national IT-infrastructure will provide a generic foundation for seamless exchange of information across systems and sectors.

Considering these aspects will make it much more likely to harvest the vast advantages by using telemedicine.



**Britta Ravn**  
HEAD OF DEPARTMENT  
Centre for Telemedicine and Telehealth  
Central Denmark Region  
[telemedicin.rm.dk](mailto:telemedicin.rm.dk)  
[centerfortelemedicin@rm.dk](mailto:centerfortelemedicin@rm.dk)



**Susanne Daugaard**  
CONSULTANT  
Centre for Telemedicine and Telehealth  
Central Denmark Region  
[telemedicin.rm.dk](mailto:telemedicin.rm.dk)  
[centerfortelemedicin@rm.dk](mailto:centerfortelemedicin@rm.dk)

