

CONNECTED HEALTH

Denmark - a telehealth nation

WHITE PAPER



About this white paper

This white paper presents the Danish approach to national implementation of telehealth and a broad range of ground-breaking solutions that contribute to making the Danish healthcare system more efficient and improve patient safety and treatment quality. It is part of a series of white papers that show how Danish solutions can contribute to increase efficiency in healthcare while empowering patients and staff.

Danish healthcare innovation is not exclusive for the Danes: many years of global presence show that our healthcare products and solutions create value internationally. Danish ideas and products are used every day in ambulances, medical clinics, hospitals, and nursing homes across the world.

We hope to inspire you and would like to invite you to Denmark to learn more about the Danish healthcare system.

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Executive Summary

● Like many other countries, Denmark has an ageing population and a growing number of chronic patients. More and more people are in need of healthcare, which places an increasing strain on public finances.

Telehealth solutions may help the healthcare system to meet this challenge in a way that also improves the quality of care.

Telehealth is not just about technology; it requires organisational change. It may act as a catalyst for new routines and workflows, which put the patient at the centre of treatment. Instead of admitting the patient to the system, the system is deployed to the patient.

In general, patients are assigned a more active role in their own treatment: They learn more about their condition, improve their self-care skills and are able to influence their own health situation. At the same time, telehealth solutions reduce the number and length of hospitalisations, enhancing the financial viability of the healthcare system.

Denmark has been working strategically with telehealth for years. At the core of these efforts are a number of small- and large-scale telehealth projects carried out across the Danish healthcare sector.

The most successful concepts are selected for further trials and development, preparing them for national dissemination.

TeleCare North

The TeleCare North project has implemented home monitoring to support patients suffering from COPD (chronic obstructive pulmonary disease).

The project has established new cross-sector roles and procedures to support the regionwide implementation of home monitoring. This has paved the way for a new integrated care model, which allows the concept to be expanded to other patient groups.

Since 2013, approximately 1,400 COPD patients in the North Denmark Region have accepted the offer of home monitoring.

Research shows that patients with severe COPD experienced improved quality of life, and the number and length of hospitalisations were reduced by 11% and 20% respectively.

Building on the positive results for COPD patients, the offer of home monitoring will now be expanded to include heart failure patients as well.

The Virtual Hospital

The virtual hospital concept allows patients to receive treatment at home and enjoy the same quality of care as they would in hospital.

It saves them the trouble of going to the hospital for control visits or treatment sessions, and frees up hospital resources at the same time.

Bispebjerg Hospital in Copenhagen has implemented a telehealth service for wound patients that has increased efficiency and patient satisfaction. Specialised municipal home nurses are responsible for the treatment, which is coordinated by a wound healing centre at the hospital. The results of the project have inspired a nationwide telehealth solution for the treatment of wounds.

At Rigshospitalet in Copenhagen, the Chemo at Home project uses a redesigned workflow to offer patients high-quality treatment without increasing expenditure.

At Aarhus University Hospital, the Department of Obstetrics and Gynaecology has implemented a telehealth solution allowing women with pregnancy complications to be monitored at home. The number of outpatient visits has been reduced, staff spend 75% less time on patient monitoring, and the number of inpatient days for women with pregnancy complications has been reduced by 44%.

Odense University Hospital has implemented a telehealth service offering home support to families with preterm babies. Instead of starting their new family life with a lengthy stay in unfamiliar hospital surroundings, the solution allows families to be discharged as soon as the baby is in no clinical danger.

Executive Summary (continued)

Telepsychiatry

For patients with a mental disorder, timely access to mental health services is often of vital importance. Telepsychiatry can provide them with faster and more flexible access to mental healthcare services, as well as the opportunity to be more directly engaged in their own treatment.

The Region of Southern Denmark has established a Centre for Telepsychiatry to empower patients and improve outcomes and service delivery through the use of telehealth.

The Internet Psychiatric Clinic gives citizens with mild to moderate depression or anxiety fast access to evidence-based treatment and guidance, without the need for a referral from their GP. Based on the positive results, it has been decided to implement the solution in all five Danish regions.

The Centre for Telepsychiatry has also implemented home-based video consultations, providing easier access to psychiatric care. Home-based video consultations also support joint decision making between patients, mental healthcare providers and other healthcare professionals.

A national infrastructure for telehealth data

Denmark's implementation of large-scale telehealth solutions between 2011 and 2015 has revealed that telehealth requires a new approach to data and data sharing.

This has led to new initiatives and a sustained focus on standardisation and further development of the Danish healthcare system's IT infrastructure in order to support telehealth on a national level.

Denmark was the first country in the world to adopt the Continua Health Alliance standard as the national standard for telehealth devices. It is now the backbone of a robust framework for implementing telehealth nationwide.

Compliance and prevention

Telehealth has the potential to inspire and motivate citizens to engage in their own health in a new way. It may increase their awareness of risk factors and facilitate close cooperation between patients, providers and professionals of the healthcare system.

At the Municipality of Esbjerg, telehealth is used to promote population health. Telehealth and preventive services have been designed to motivate chronic patients to adopt a healthy lifestyle and improve their compliance with treatment.

At the Municipality of Holstebro, a study has documented how a telehealth solution supporting home blood pressure measurement has reduced the reporting bias normally associated with the detection of hypertension. The study not only revealed that many patients were being treated on the basis of an inaccurate diagnosis. It also identified a number of citizens with undiagnosed hypertension.

Odense University Hospital is collaborating with the national health authorities on a project that will make screening for colorectal cancer more efficient. Since 2014, all Danish citizens between the ages of 50 and 74 have been offered screening for colorectal cancer – either a colonoscopy, which is a highly accurate, but invasive procedure, or a stool test, which is non-invasive, but much less accurate. A new "camera pill" technology allows colonoscopy diagnostics to be carried out in the patient's own home, significantly reducing the risk and discomfort associated with conventional screening methods.

Some of Denmark's most promising and successful telehealth concepts are described in further detail in the following pages – along with the potential or documented gains for the patients as well as the healthcare system as a whole.

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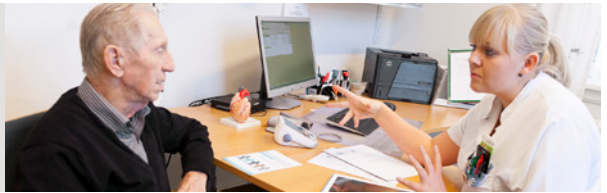
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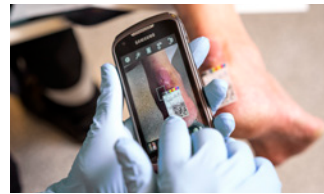
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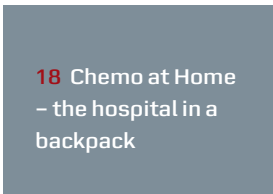
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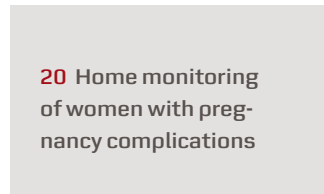
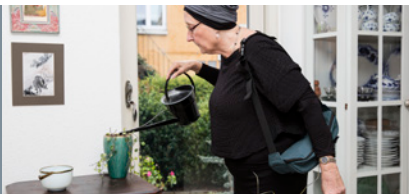
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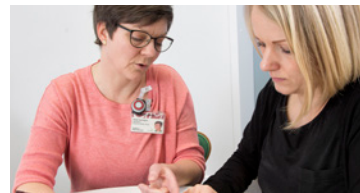
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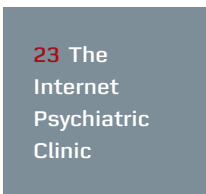
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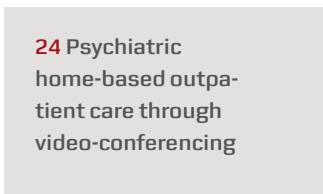
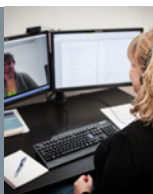
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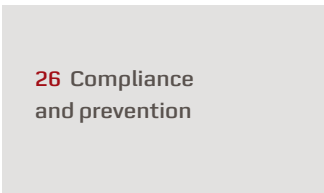
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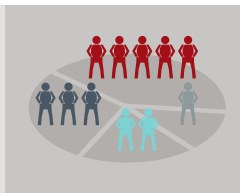
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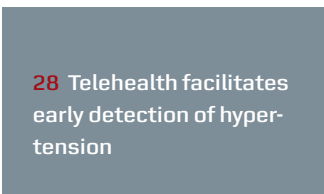
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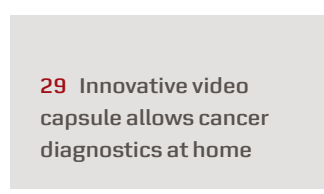
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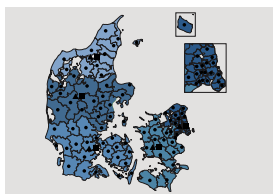
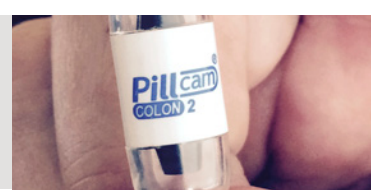
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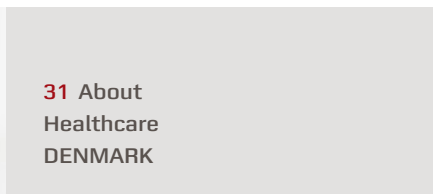
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• Ellen Trane Nørby
Minister for Health

“Through hands-on experience from large-scale projects and day-to-day operations, we have learned that telehealth is smarter healthcare: Instead of sending the patient to the system, we deploy the system to the patient, benefitting everyone involved.”

Foreword

● **Through years of innovation and co-operation, Denmark has created a modern healthcare system that keeps the patient in focus. We believe that healthcare should be universally available and based on the needs of the patient, not the needs of the system.**

However, an ageing population and a growing number of chronic patients mean that more people are going to need healthcare in the future, which will put increased pressure on public finances. Adopting new technologies can help us overcome this challenge and create a better and smarter healthcare system.

When the challenge is to deliver high-quality care to more people with the same resources available, telehealth is one of the solutions. Therefore, we are working hard to create and adopt new innovative solutions throughout the Danish healthcare system. One way of doing this is through national dissemination

of telehealth and cross-sector collaboration. We do this not only to balance budgets now and in the future, but first and foremost to ensure that we continue to deliver high-quality and patient-centred healthcare. Healthcare should be convenient, cohesive and citizen focused.

“Denmark is already a frontrunner in providing cost-efficient, citizen-centred healthcare of the highest quality.”

Through hands-on experience from large-scale projects and day-to-day operations, we have learned that telehealth is smarter healthcare: Instead of sending the patient to the system, we deploy the system to the patient, benefitting everyone involved. Patients learn more about their condition, increase their self-care skills and may even acquire

the ability to influence their own condition, while clinical staff can focus more on other patients needing intense, on-site care. Furthermore, telehealth helps reduce the number and length of hospitalisations, while increasing patients’ quality of life and the financial viability of our healthcare system at the same time.

Telehealth supports existing workflows and treatments that are being carried out with a high level of expertise. The new technological opportunities can connect different parts of the healthcare system in smarter and more efficient workflows. Therefore, telehealth is considered an area with considerable potential by clinical staff, healthcare experts and welfare technology companies.

Denmark is already a frontrunner in providing cost-efficient, citizen-centred healthcare of the highest quality. And we are just getting started: By adopting and expanding the use of telehealth and other technologies,



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Minister for Public Sector Innovation



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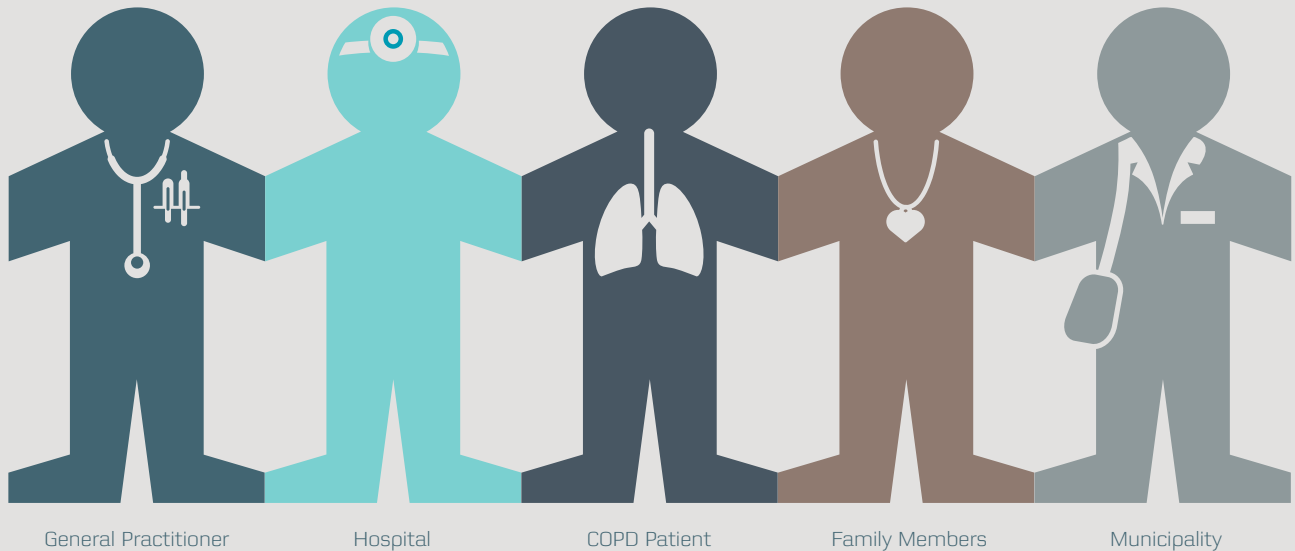
we aim to keep Denmark at the forefront of technological development – to the benefit of citizens and society alike.

We hope this white paper will provide readers with inspiration and knowledge about Denmark’s experience so far within this promising field.

Ellen Trane Nørby
Minister for Health

Sophie Löhde
Minister for Public Sector Innovation

Stephanie Lose
Chairman of Danish Regions



: Patient centered telehealth

The Telecare North project puts the patient in the center of attention from the GP, the hospital, the municipality, and family members. The telehealth project facilitates the collection and sharing of information in order to improve both patient insight and compliance as well as efficient and timely interaction by clinicians and relatives.

TeleCare North – home monitoring on a grand scale

● **TeleCare North is one of three large-scale telehealth projects in Denmark. The aim is to transfer telehealth concepts from small pilot projects to solutions covering an entire region, subsequently making the case for national implementation.**

In 2011, Denmark launched three large-scale telehealth projects, each with the aim of implementing telehealth solutions for all relevant chronic patients in a particular region.

Among them is the TeleCare North project in the North Denmark Region – a collaborative effort between the regional authority, its hospitals, GPs and 11 municipalities.

The main focus of the project is home monitoring.

The general idea of home monitoring is to measure indicators such as blood pressure or pulse rate in the patient’s own home. The patient is provided with the necessary equipment to perform the tests, while healthcare professionals can monitor the patient’s data

and respond proactively to disease deterioration or other changes in the patient’s condition.

“One of the major benefits of TeleCare North is that it allows us to perform healthcare tasks at the most efficient cost level. For instance, a GP or a municipal nurse now performs tasks that previously required an outpatient visit or hospitalisation.”

The concept includes tools such as video consultations, home training and solutions that enable patients to access patient networks or other sources of knowledge about their condition. It may also be supplemented with questionnaires, where the patient responds to health-related questions through an easy-to-use telehealth app.

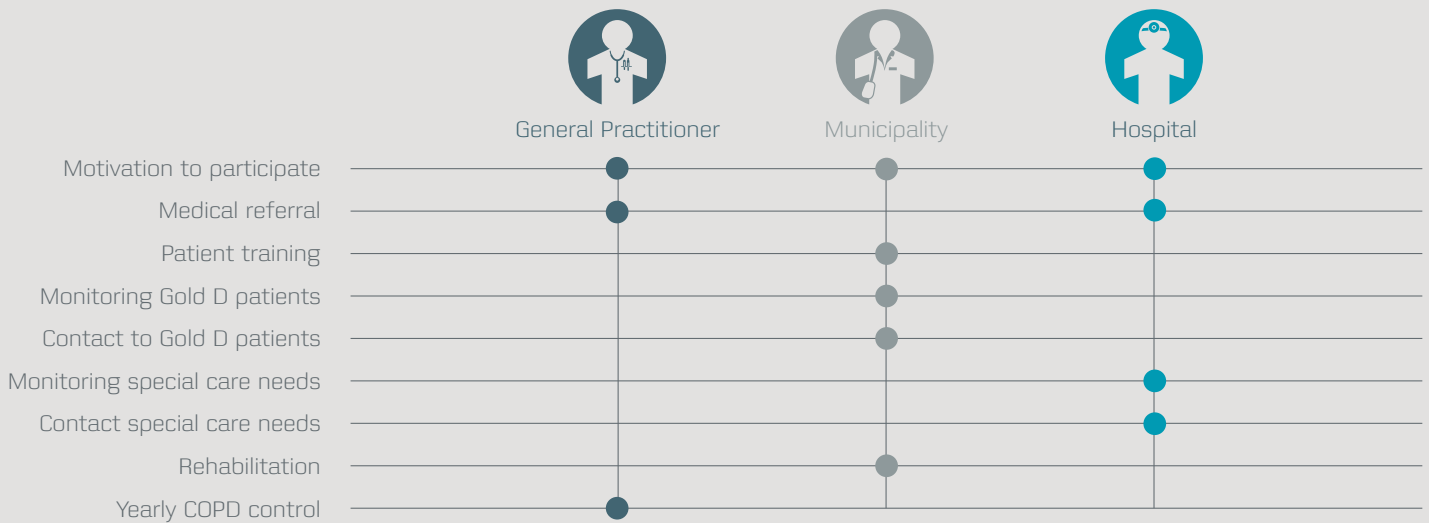
“One of the major benefits of TeleCare North is that it allows us to perform healthcare tasks at the most efficient cost level. For instance, a GP or a municipal nurse now performs tasks that previously required an outpatient visit or hospitalisation,” explains Tina Heide, Project Executive for TeleCare North.

More than technology...

Home monitoring is not just about new technology. It is also about using technology to reinvent processes of long-distance services that allow data to “follow” the patient and be shared among the different operators, sectors and professionals involved in the patient’s care and treatment.

This perspective has been a key element in Denmark’s approach to home monitoring and other telehealth concepts: It is focused on the optimal use of healthcare resources and based on a close and well-functioning collaboration between regional authorities, hospitals, municipalities and GPs.

TeleCare North has established and defined new cross-sector roles, procedures and pro-



: An Integrated Care model for telehealth

The Telecare North project required a new way of organizing referral of patients to telehealth and determining the cooperation between clinical professionals in hospitals, primary care and municipalities. Therefore, an Integrated Care model to document this new kind of workflow was developed.

cesses to support the region-wide implementation of home monitoring. This has, in turn, resulted in a new integrated care model – a platform that will enable other telehealth initiatives in the region or nationwide.

The scalability is supported by an interorganisational service centre concept to deliver the logistics, education and maintenance solutions that are necessary to operate large-scale telehealth services.

The integrated care model has been tried and tested with COPD (chronic obstructive pulmonary disease) patients and heart failure patients, and North Denmark Region is now ready to adapt it to fit the needs of other patient groups.

A concept ready for scaling

Implementation of home monitoring requires a well-functioning IT infrastructure, telehealth equipment and solutions designed to meet the needs of patients and healthcare professionals.

In the TeleCare North project, the technical solution is based on a flexible open-source telehealth platform. This makes it possible to expand the home monitoring concept to other patient groups and to integrate new devices and technologies.

The Telecare North participants

- 1256 Patients
- The Danish Lung Association
- The municipalities in North Jutland
- The GPs in North Jutland
- The North Denmark Region
- The 4 hospitals in North Jutland
- Aalborg University



Improving quality of life for COPD patients

- The TeleCare North project has provided home monitoring for COPD patients in the North Denmark Region. They now experience fewer and shorter hospitalisations as well as improved quality of life.

COPD (chronic obstructive pulmonary disease) is a disease that develops over time, slowly reducing the patient's ability to engage in everyday activities. As the disease progresses, breathing and moving around will require more effort, leading to social isolation and reduced quality of life.

Telehealth solutions make it possible to track the development of the disease more closely and establish early interventions. Evidence shows that treatment involving telehealth also increases COPD patients' confidence and knowledge about their disease. Since 2013, approximately 1,400 COPD patients in the North Denmark Region have accepted the offer of telehealth home monitoring.

Twice a week, the patient tests blood pressure, pulse rate, saturation and weight with equipment connected via Bluetooth to a tablet and a user-friendly telehealth app. The patient also responds to health-related questions about breathing difficulties and coughing. The results are immediately transmitted through mobile broadband, and healthcare professionals may take action at any given time if necessary.

Empowering patients

Home monitoring gives patients a more active role in their own treatment. The majority of patients experience improvements with regard to disease control, confidence and self-management. For instance, they are able to respond to early signs of deterioration and prevent hospitalisation in favour of personalised self-management plans from their own GP.

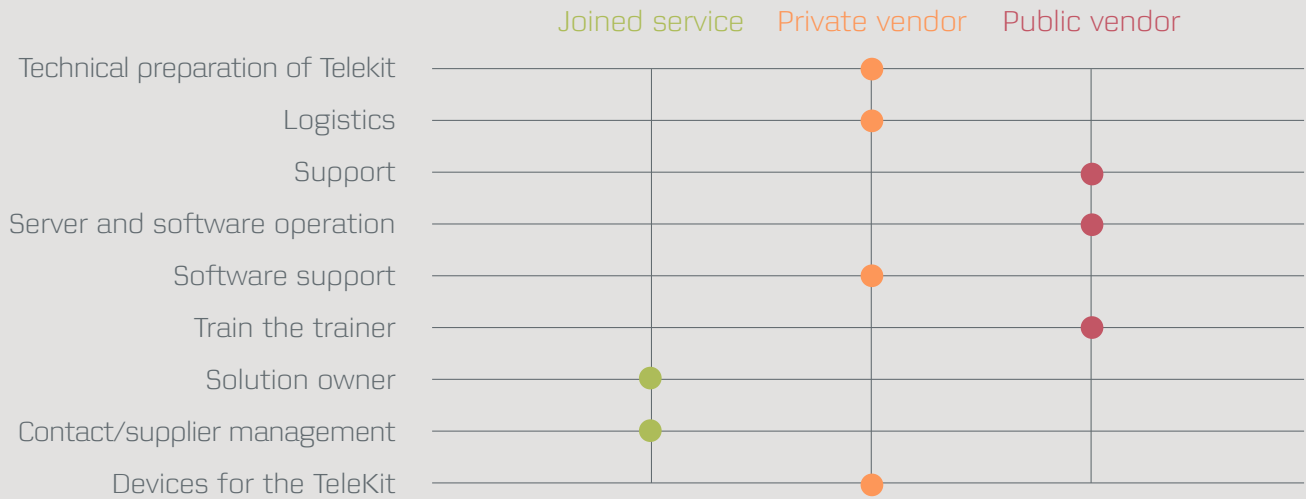
Due to increased knowledge about their own illness, they also feel better equipped for the dialogue with healthcare professionals.

For patients with severe COPD, telehealth has increased rehabilitation activities by 9%. This is important, because exercise helps patients maintain their functional ability, improves their independence, and reduces the need for healthcare services.

“The group of patients with severe COPD experienced improved quality of life, and the number and length of hospitalisations were reduced by 11% and 20% respectively.”

The offer of telehealth home monitoring to COPD patients in the North Denmark Region is based on solid randomised clinical trials results from four PhD studies conducted in collaboration with TeleCare North.

When evaluating the effects of telemedicine, health economics plays a key role. In the TeleCare North project, the health economic



: The telehealth support centre

The Telecare North project revealed the need to establish a telehealth support centre where public and private organizations can work together with the purpose to establish the logistics support, which is needed to implement telehealth on large-scale.

impact is measured in QALYs (quality-adjusted life years), an overall indicator of the value of health outcomes based on length of life and quality of life.

The results show that the group of patients with severe COPD experienced improved quality of life, and the number and length of hospitalisations were reduced by 11% and 20% respectively.

Empowering patients

- Most patients (61.7%) experienced improved control of their disease by using the system.
- Most patients (71.7%) experienced improved security by using the system.
- Half of the patients (50%) experienced increased awareness of their COPD symptoms and responded proactively.
- The majority of patients (96%) found the system "easy" or "very easy" to use.
- 27% of patients experienced more freedom.
- Patients with severe COPD experienced enhanced quality of life.

These findings are not affected by the patient's level of health literacy or socio-economic affiliation.

Source: Research findings on patient-related effects and health literacy.



Proving the case for heart patients

● Heart patients will be the next patient group to benefit from telehealth home monitoring in the North Denmark Region. The project, TeleCare North Heart Failure, is based on the existing telehealth platform and includes the Integrated Care model and the interorganisa-tional service centre concept.

Building on the positive results from the COPD project, the North Denmark Region has decided to focus on heart failure patients as the next chronic patient group to benefit from telehealth home monitoring.

Whereas patients with COPD have typically lived with their condition for several years before they are offered a home monitoring solution, heart failure patients are introduced to telehealth immediately after they are diagnosed.

How it works

The first steps are taken as part of the so-

called up-titration process, where the hospi-tal's heart failure clinic educates the patient and initiates treatment.

In addition to ensuring the correct medica-tion, the solution provides patients with skills and insight into their own disease as well as the tools to cope with it. It is complemented by outpatient controls and questionnaires fo-cusing on early signs of deterioration.

The patient is provided with the equipment necessary for self-monitoring, including a pulse rate and blood pressure gauge, weigh-ing scales and a tablet equipped with the telehealth app.

The patient's self-monitoring is followed closely at the hospital, where staff responds to any signs of deterioration, ensuring rapid adjustment of medication.

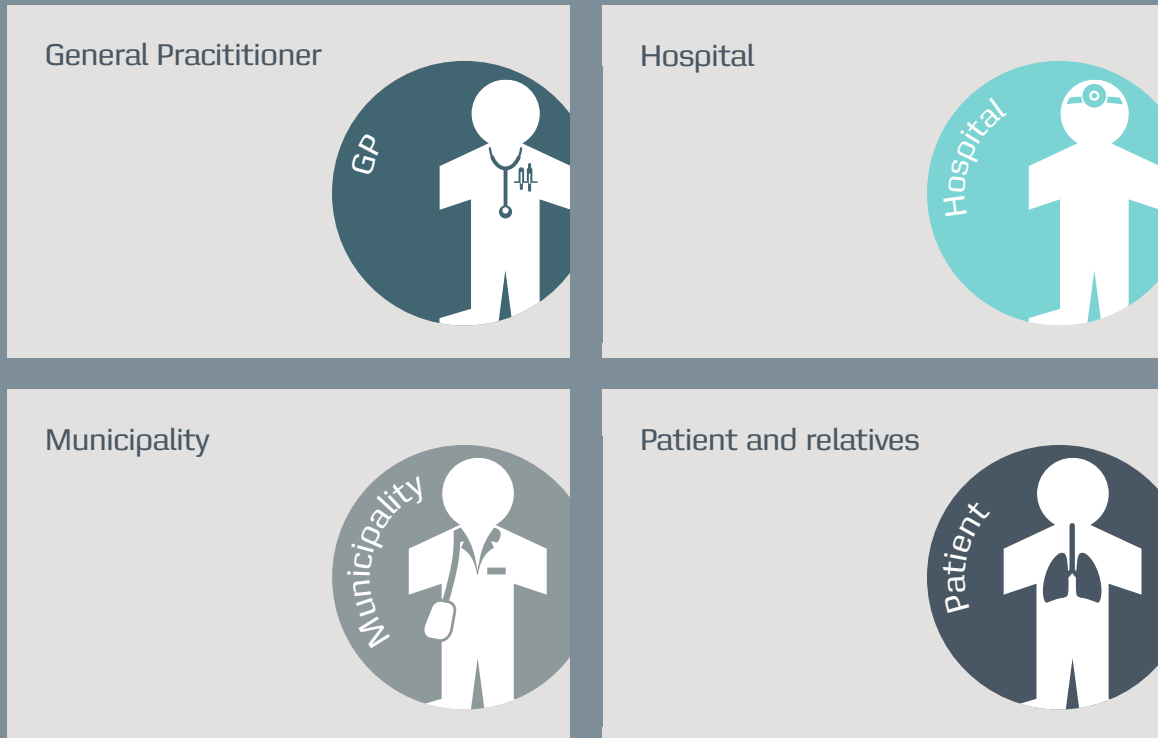
After completing the up-titration process at the heart failure clinic, the self-monitoring continues in the patient's own home. The re-

sponsibility for following up on the patient's data is transferred from the hospital to the municipal level, which is also responsible for rehabilitation and prevention efforts.

"In addition to ensuring the correct medication, the solu-tion provides patients with skills and insight into their own disease as well as the tools to cope with it. It is complemented by outpatient controls and questionnaires focusing on early signs of deterioration."

A step towards national implementation

Heart failure may have severe consequences for a person's general well-being and quali-ty of life. But without a telehealth solution,



: Patient centered co-operation

The TeleCare North Heart Failure project facilitates a transparent and patient centered co-operation between hospital, municipality, GP, the patients and their relatives, which supports patient self-monitoring and compliance.

heart patients would not have regular contact with the healthcare system after the up-titration process.

Evidence shows that patients tend to lose focus on their symptoms 12-18 months after the up-titration process, and many experience deterioration and/or rehospitalisation.

The number of heart patient admissions in Denmark has doubled in 15 years, and a large number of patients suffer from both COPD and heart failure.

Therefore, the heart failure project also aims to establish a model for home monitoring of patients with more than one diagnosis.

Proving the case through research

The framework is provided by the project TeleCare North Heart Failure, an RCT (randomized controlled trial) study running until the end of 2018. The study, which is carried out in collaboration with Aalborg University, seeks to assess the effect of telehealth home monitoring for heart patients.

The expected result is that telehealth home monitoring leads to fewer hospitalisations for this patient group.

The purpose of the study is to determine whether telehealth support for patients with heart failure is suitable for national implementation. As patients with heart failure are often

of working age, the research also focuses on the possible impact of the patient's labour market participation and/or dependence on sickness benefits.

Finally, the research will assess whether municipalities are able to support patients in maintaining their ability to cope through home monitoring.



: TeleCare North equipment for patient self monitoring.



• A nurse at a hospital telehealth center instructs a telehealth patient on how to use a device.

The Virtual Hospital

- A virtual hospital concept uses telehealth solutions to reduce the need for hospitalisation. It improves patient satisfaction as well as cost efficiency.

Telehealth solutions based on video consultations, apps for mobile devices, home monitoring, and mobile treatment now make it possible to treat patients at home.

Odense University Hospital has implemented a solution that enables patients to be “hospitalised at home”: They can receive treatment at home and enjoy the same quality of care as they would in hospital. They are, in a sense, admitted to a virtual hospital.

“Shorter periods of hospitalisation is a strategic goal for Odense University Hospital. Telehealth enables patients to be discharged earlier by being “hospitalised at home”. It improves the quality and efficiency of treatment and offers more empowerment and quality of life for patients,” says Peder Jest, CMO at Odense University Hospital.

Unburdening patients – and hospitals

The virtual hospital concept saves patients the trouble of going to the hospital for control visits or treatment sessions, potentially improving their chances of living a normal life.

At the same time, it relieves the strain on hospital resources by reducing the length and number of hospital stays. This allows hospitals to focus on admitted patients and deliver high-quality healthcare services to all citizens. It also ensures a better transition from the hospital to the municipal care system, which is responsible for ongoing rehabilitation.

The following cases describe how Danish hospitals have implemented virtual hospital solutions in the areas of wound treatment, chemotherapy, pregnancy complications and neonatal care.



• The New Odense University Hospital



• Peder Jest
CMO at Odense University Hospital

“Shorter periods of hospitalisation is a strategic goal for Odense University Hospital. Telehealth enables patients to be discharged earlier by being “hospitalised at home”. It improves the quality and efficiency of treatment and offers more empowerment and quality of life for patients,” says Peder Jest, CMO at Odense University Hospital.



Home-based wound treatment increases efficiency and patient satisfaction

At Bispebjerg Hospital, a telehealth service for wound patients has increased efficiency and patient satisfaction. Specialised home nurses are responsible for the treatment, which is coordinated by a wound healing centre at the hospital. The project has paved the way for a nationwide telehealth solution for the treatment of wounds.

An estimated 50,000-60,000 people in Denmark have chronic, non-healing wounds, typically due to diabetes, decreased function of the venous or the arterial system or unacceptable external pressure on exposed skin areas.

These types of wounds heal very slowly, with the added risk of severe complications, leading to amputation in worst cases. Because the patient's underlying condition may not disappear, the wounds often need several treatments before healing.

To improve the quality of treatment, the Copenhagen Wound Healing Center (CWHC) at Bispebjerg Hospital offers a telehealth service where municipal home care nurses can treat patients at home, in nursing clinics, rehabilitation centres and retirement homes. Nurses specialised in wound care are responsible for updating the wound chart at least

every two weeks to guarantee an optimal treatment plan.

A specialised education programme

To ensure that nurses have the required wound management and therapeutic skills, they must first pass a multidisciplinary course, led by medical doctors, experienced nurses and podiatrists.

“Patients and wound care nurses report high levels of satisfaction with telehealth solutions: Patients feel more involved and do not have to travel as much. Nurses feel that their skills have improved and that they can provide a better service for their patients.”

The course authorises nurses to refer patients to telehealth treatment without consulting a GP. All nurses are offered an annual follow-up course at the CWHC to make sure they are up to date on wound treatment and patient care.

The telehealth project has significantly reduced the average referral-to-treatment time from the primary healthcare sector to the hospital.

Based on its work with wound treatment, Bispebjerg Hospital plans to expand the use of telehealth.

Nationwide implementation

These positive results have paved the way for a national telehealth concept for wound treatment from 2012-2015.

The national implementation includes the option for municipal nurses to photograph wounds with their mobile phones and upload the images to a web-based electronic patient record. A specialist may then prescribe new treatment or medication as necessary.

Patients and wound care nurses report high levels of satisfaction with telehealth solutions: Patients feel more involved and do not have to travel as much. Nurses feel that their skills have improved and that they can provide a better service for their patients.

Furthermore, the referral-to-treatment time from the primary healthcare sector to the hospital has decreased considerably.

“Telehealth allows municipal nurses to photograph wounds with their mobile phones and upload the images to a web-based electronic patient record. A specialist may then prescribe new treatment or medication as necessary.”





When a patient receives treatment at home, he or she will be able to contact the service team at the hospital 24/7/365.

Chemo at Home – the hospital in a backpack

● A portable digital pump, a redesigned workflow and a service design approach are at the core of Rigshospitalet's award-winning "Chemo at Home" concept. For patients diagnosed with acute leukaemia, it has reduced the average number of hospital days for inpatients from 30 to 10.

Even with a critical diagnosis, patients want to keep their everyday routines, spend time with their families and friends and maintain some control over their lives.

To meet these needs, Rigshospitalet in the Capital Region of Denmark has introduced the "Chemo at Home" concept. It offers patients with acute leukaemia the opportunity to receive most of their treatment at home, without the presence of clinical staff. To qualify, patients must meet a set of compliance criteria and more than 90% do.

An award-winning concept

The concept is available for intensive chemotherapy as well as treatment with intrave-

nous antibiotics. The chemotherapy or antibiotics are provided in a backpack, with a programmable pump connected to an intravenous catheter.

"The "Chemo at Home" concept makes it possible for patients to receive higher-quality treatment at the same (or at a lower) cost."

The pump controls the infusions and the treatment is selected by the nurse from a table of presets. Patients are trained on restart procedures and how to keep the catheter free from bacteria. The pump is locked so that patients cannot accidentally reset anything.

The patient visits the hospital every two or three days to get a check-up, pick up a new supply of medicine and receive transfusions if necessary. They usually return home within two hours.

The clinic is also available for calls 24/7.

The "Chemo at Home" concept makes it possible for patients to receive higher-quality treatment at the same (or at a lower) cost. It has reduced the average number of inpatient days from 30 to 10, freeing up beds for elderly cancer patients who are more in need of hospital care.

Chemotherapy at home was implemented in Denmark's four other regions in 2016 in close cooperation with Rigshospitalet, which provides implementation service and support.

"Chemo at Home" received the "European Public Sector Best Practitioner Award" from the European Institute of Public Administration (EIPA) in 2015, the Danish "Golden Scalpel Healthcare Award" for best national clinical initiative from the weekly medical journal Dagens Medicin in 2016, and the "Implementation and Impact Award" from the International Confederation of Nurses in 2017.



Chemo at Home

CONCEPT (COMBINATORIAL INNOVATION)

- A portable digital pump, a redesigned workflow and a service design approach including co-designing and testing with patients.
- Treatment with intensive chemotherapy at home without any clinical staff present.
- Hospital check-up every two or three days.
- 24/7/365 service team available at the hospital.

IMPACT

- Substantial increase in patients' quality of life.
- Average reduction in days as inpatient from 30 to 10.

IMPLEMENTATION

- Developed and tested at Rigshospitalet during 2014.
- Implemented at Rigshospitalet during 2015, including the use of antibiotics in five other clinics.

FURTHER POTENTIAL

- Scaled to the other five Danish clinics of haematology during 2016.
- Scaling the use of intravenous treatment with antibiotics at home for other patient groups.



Home monitoring of women with pregnancy complications

● **Pregnancy complications usually call for hospitalisation. But Aarhus University Hospital now offers home monitoring as an alternative for women who experience health problems during pregnancy.**

When women experience complications during pregnancy, hospitalisation is usually the standard response.

Complications like premature rupture of membranes (“waters breaking” before the baby has reached full term) or pre-eclampsia (a condition characterised by high blood pressure and the risk of damage to organs) require close monitoring to ensure the well-being of mother and baby.

While home monitoring solutions for measuring physical parameters and detecting early warning signs have been available for years, the monitoring of biochemical parameters has only been possible at hospitals.

To improve this situation, the Department of Obstetrics and Gynaecology at Aarhus

University Hospital has now tested and implemented a telehealth solution allowing women with pregnancy complications to be monitored in their own home.

An open-source platform

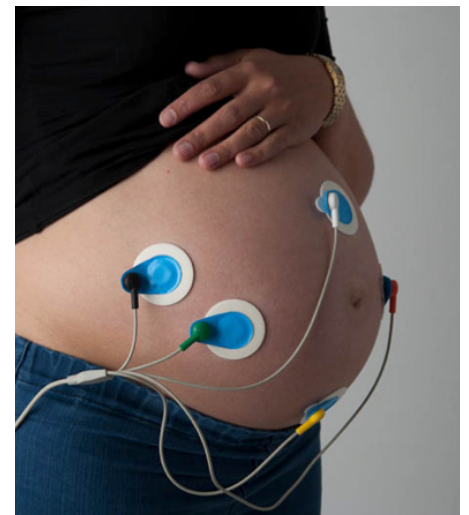
It is built on a user-friendly open-source platform, developed in collaboration between patients and professionals with a participatory design approach. The underlying methods have been developed in close cooperation between public healthcare providers, research institutions and private telehealth enterprises.

During implementation of the new methods, hospitalised pregnant women requested to use the system for self-monitoring during their stay at the hospital, highlighting the potential of redesigning and optimising workflows in a hospital context.

Transferring a selected group of pregnant women from hospitalisation to home monitoring has led to substantial benefits for patients and hospital staff, without lowering satisfaction levels or quality of care. The number of outpatient visits has been reduced,

staff spends 75% less time on patient monitoring, and the number of inpatient days for women with pregnancy complications has been reduced by 44%.

The project at Aarhus University Hospital has led to an agreement between Danish Regions and the Government to implement home monitoring of women with pregnancy complications on a national level by 2020.





Neonatal home care – telehealth support for premature babies and their families

- **Odense University Hospital has introduced a telehealth service that relocates neonatal care from the hospital to the family's own home.**

Preterm birth is often associated with hospitalisation at a neonatal unit. In the Danish healthcare system, the general practice is to keep mother and baby at the hospital until the original due date in order to monitor their condition and ensure their well-being.

But this has a number of practical implications for the family. They have to wait longer before they begin a normal family life at home, they often struggle to get enough rest and it is more difficult to begin breastfeeding in a "foreign" hospital environment.

To give families more freedom and flexibility, several Danish hospitals have tested solutions that enable neonatal care in the family's own home.

Early discharge

Odense University Hospital (OUH) has implemented a telehealth service that allows fami-

lies to be discharged as soon as the baby is in no clinical danger.

The hospital provides the family with a tablet, a customised scale for weighing the infant and a measuring tape to monitor the growth of the baby's head.

"The family has video consultations with a hospital nurse twice a week to ensure that the baby is healthy and growing as it should."

At home, the family receives support from the hospital through an app that contains information about prenatal care, instruction videos and the option of sending text messages and pictures of the baby to hospital staff. The app also provides the family with a nourishment schedule provided by health professionals.

The family has video consultations with a hospital nurse twice a week to ensure that

the baby is healthy and growing as it should. And as an extra precaution, a doctor at the hospital checks the child every two weeks.

The solution is integrated with the electronic medical record, which makes it easy for hospital staff to review information, reply to messages and store everything in the patient records. Since the neonatal telehealth service was implemented in November 2015, it has been used by more than 200 families, saving them from unnecessary days in the hospital and giving each family a better start in their new family life and freeing up beds for other patients.

The Hans Christian Andersen Children's Hospital at OUH considers the telehealth solution a big success and is now looking to expand the solution to include other paediatric patient groups. The objective is to give more children the possibility to stay in familiar surroundings while receiving treatment and care from specialists.



: The Centre for Telepsychiatry in the Region of Southern Denmark operates the Internet Psychiatry Clinic and supports implementation, research and development of new tele psychiatry services.

Telepsychiatry – improving access to mental health treatment

- Digital technologies such as videoconferencing, mobile apps and interactive software can provide faster, easier and more cost-effective access to psychiatric help.

For patients with a mental disorder, timely access to mental health services is of vital importance to help prevent their symptoms increasing and their condition worsening.

Limited resources and a lack of integration between different operators and services make it a challenge to meet all patient needs within the existing framework for mental healthcare.

In this context, telepsychiatry has the potential to provide patients with faster and more flexible access to mental healthcare services, as well as the opportunity for them to be more directly engaged in their own treatment. In an international context, telepsychiatry is

defined as the application of telemedicine to the field of psychiatry. This typically involves mental healthcare services delivered with telecommunication technology.

In general, telepsychiatry allows for a more efficient use of the psychiatrist's time. It is especially relevant in specialised fields where there is a shortage of psychiatrists, such as child and adolescent psychiatry, or in rural or underserved areas.

To explore the potential of telepsychiatry, the Region of Southern Denmark has established the Centre for Telepsychiatry – a research and development centre devoted to developing, researching and implementing innovative digital solutions that are safe and clinically effective.

The centre collaborates with patients, mental healthcare professionals, researchers and IT developers to improve outcomes and

service delivery through the use of digital technologies.

: Anxiety and depression on the rise

Anxiety is the most widespread mental disorder in Denmark. 136,000 patients are registered with anxiety disorder, and 17,000 new cases are added every year.

Depression poses a similar challenge. International studies indicate that depression affects 11% of the population in Europe with a trend towards becoming the most serious mental disease for society by 2030.



The Internet Psychiatric Clinic

● **The Region of Southern Denmark offers online psychological therapy to citizens with mild to moderate depression and anxiety. They have fast access to evidence-based treatment without the need for a doctor's referral.**

In the Region of Southern Denmark, patients suffering from mental illnesses such as mild depression or anxiety receive internet-based psychological therapy at home.

This service is provided by the Internet Psychiatric Clinic. Originally launched as a demonstration project in the National Action Plan for Dissemination of Telemedicine 2012-2015, the online clinic now operates as part of the Mental Health Services in the Region of Southern Denmark.

The clinic gives citizens fast access to evidence-based treatment and guidance, without the need for a referral from their GP. A growing number of patients contact the clinic themselves, often on the recommendation of friends or relatives.

The clinic's self-help treatment programme includes questionnaires about symptoms, short educational videos and cognitive behavioural therapy, in which patients practice skills that will help them cope with their condition. The treatment includes a video-based assessment interview and a video-based end-of-treatment interview after 10-12 weeks of online treatment.

Self-referral 24/7

While assessment interviews and therapist support are only available during office hours, patients who experience symptoms of anxiety or depression may seek treatment themselves through the clinic's website at any time, day or night.

The clinic's services are offered to adults (18 years and over) with a primary diagnosis of mild to moderate depression or anxiety, no record of substance abuse and no bipolar or psychotic disorders. They need to understand and write Danish, and have access to a computer and broadband internet connection.

The clinic is operated by the Region of Southern Denmark's Centre for Telepsychiatry. The centre is carrying out randomised trials to investigate clinical outcomes, cost effectiveness, patient satisfaction and the usability of internet-based therapy for depression and anxiety disorders.

"It does not keep me from working while I am in treatment – and it gives me more energy to do my own treatment exercises at home. On days when I do not feel well and find it difficult to leave home, I can still do my exercises at home and be compliant with my treatment," one patient explains.

Towards national implementation

In the period 2018-2020, internet-based therapy for depression and anxiety will be made available nationwide to citizens across the five Danish regions. The Internet Psychiatry Clinic will treat approximately 1,400 patients per year.



Psykiatrien i Region Syddanmark Telepsykiatrisk Center

: Centre for Telepsychiatry in Region of Southern Denmark.

Psychiatric home-based outpatient care through videoconferencing

- Home-based video consultations make it easier for patients to gain access to psychiatric care.
- Videoconferencing also supports joint decision making between patients, mental healthcare providers and other healthcare professionals.

Since 2013, remote videoconferencing between clinicians and patients has been piloted in the Mental Health Services in the Region of Southern Denmark. From 2015, videoconferencing has been implemented at scale in the hospital, with reimbursement for the service equalling that of in-person consultation.

For many of the patients, leaving one's home for treatment requires some effort in itself, and the option of videoconferencing makes a big difference.

Every department in the region's mental health service has videoconferencing equipment and offers video consultations be-

tween patient and provider for treatment and follow-up.

The use of video consultations includes scheduled and urgent outpatient visits, medication management, psychotherapy and other forms of therapeutic and supportive consultations.

The video consultation service is based on a bring-your-own-device model where patients use their own tablets or desktop computers. Videoconference software and support are managed by the IT department of the Mental Health Services.

A tool for healthcare professionals

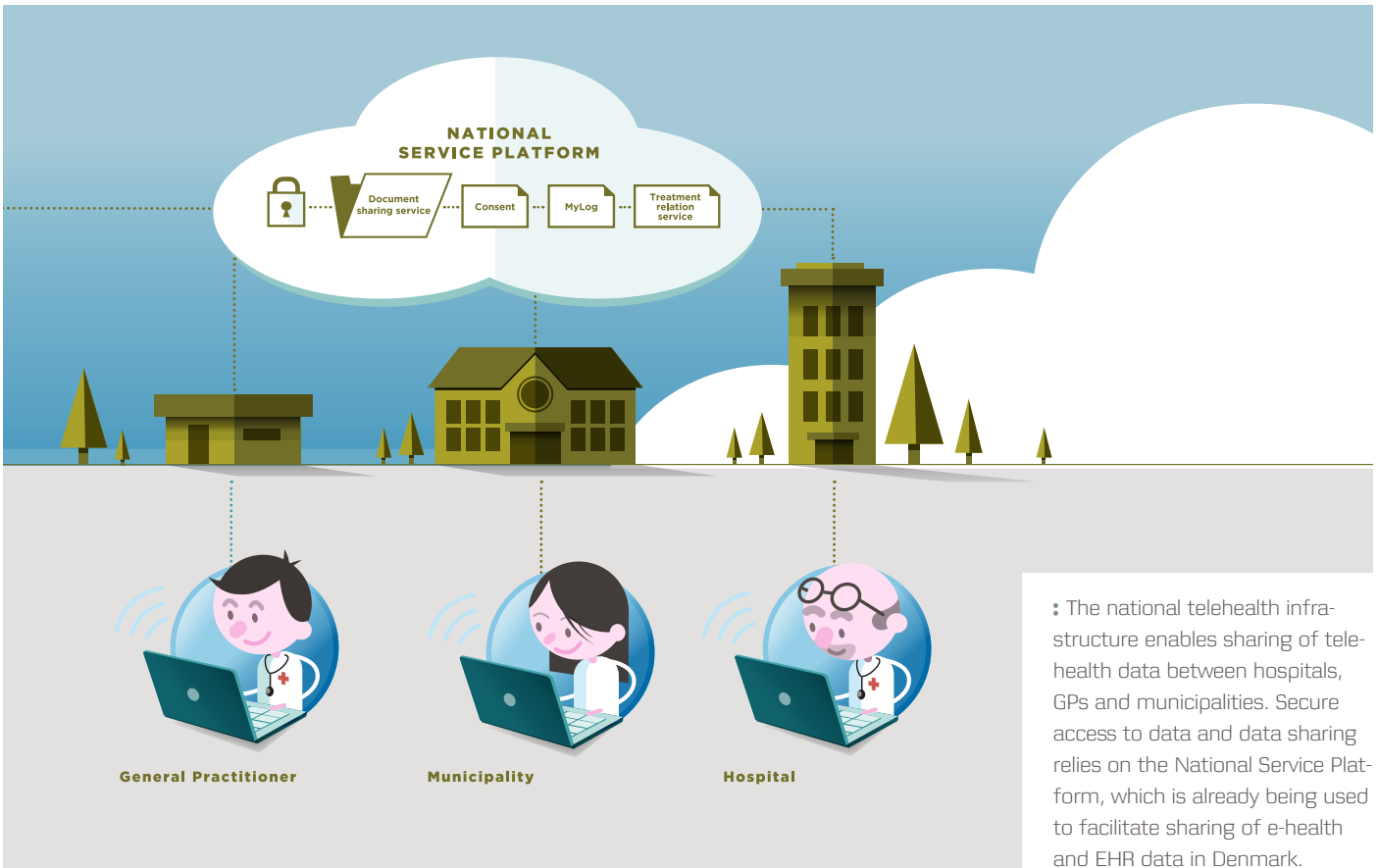
In addition to patient-professional consultations, videoconferences are also used by psychiatrists and other healthcare professionals (GPs and municipal healthcare providers) for joint decision making.

The Centre for Telepsychiatry has developed a suite of educational resources including

e-learning modules that support the use of video consultations by clinicians and patients.

It has also chaired a clinical work group tasked with developing practice guidelines for video-based mental healthcare covering, regulatory, technical and administrative issues.

- Since 2013, remote video consultation between clinician and patient has been piloted in the Mental Health Services in the Region of Southern Denmark.
- From 2015, videoconferencing has been implemented at scale in the hospital with reimbursement for service equaling in-person consultation.
- 486 video consultations were performed during the first year. In 2017, the number increased to 1,816 and a further increase in the number of video consultations is expected in the coming years.



A national infrastructure for telehealth data

● Denmark’s nationwide implementation of telehealth relies on a well-developed infrastructure based on international standards that facilitate data sharing and integration across the healthcare system.

Denmark’s implementation of large-scale telehealth solutions between 2011 and 2015 revealed that telehealth requires a new approach to data and data sharing.

Firstly, it relies on a new type of data gathered from questionnaires and devices used by patients, often at home. Secondly, it requires that data are shared between hospitals, municipal healthcare providers, GPs and other healthcare professionals. This, in turn, raises new concerns about data security.

This calls for common standards and procedures for handling large amounts of data as well as a shared terminology that ensures that clinical staff can access, interpret and share data from different telehealth devices.

In 2012, Denmark was the first country in the world to adopt the Continua Health Alliance standard as the national standard for telehealth devices.

Since then, Denmark has implemented a national architecture for data sharing. This is based on the international Health Level 7 (HL7) standards for transfer of clinical and administrative data between software applications used by different healthcare providers.

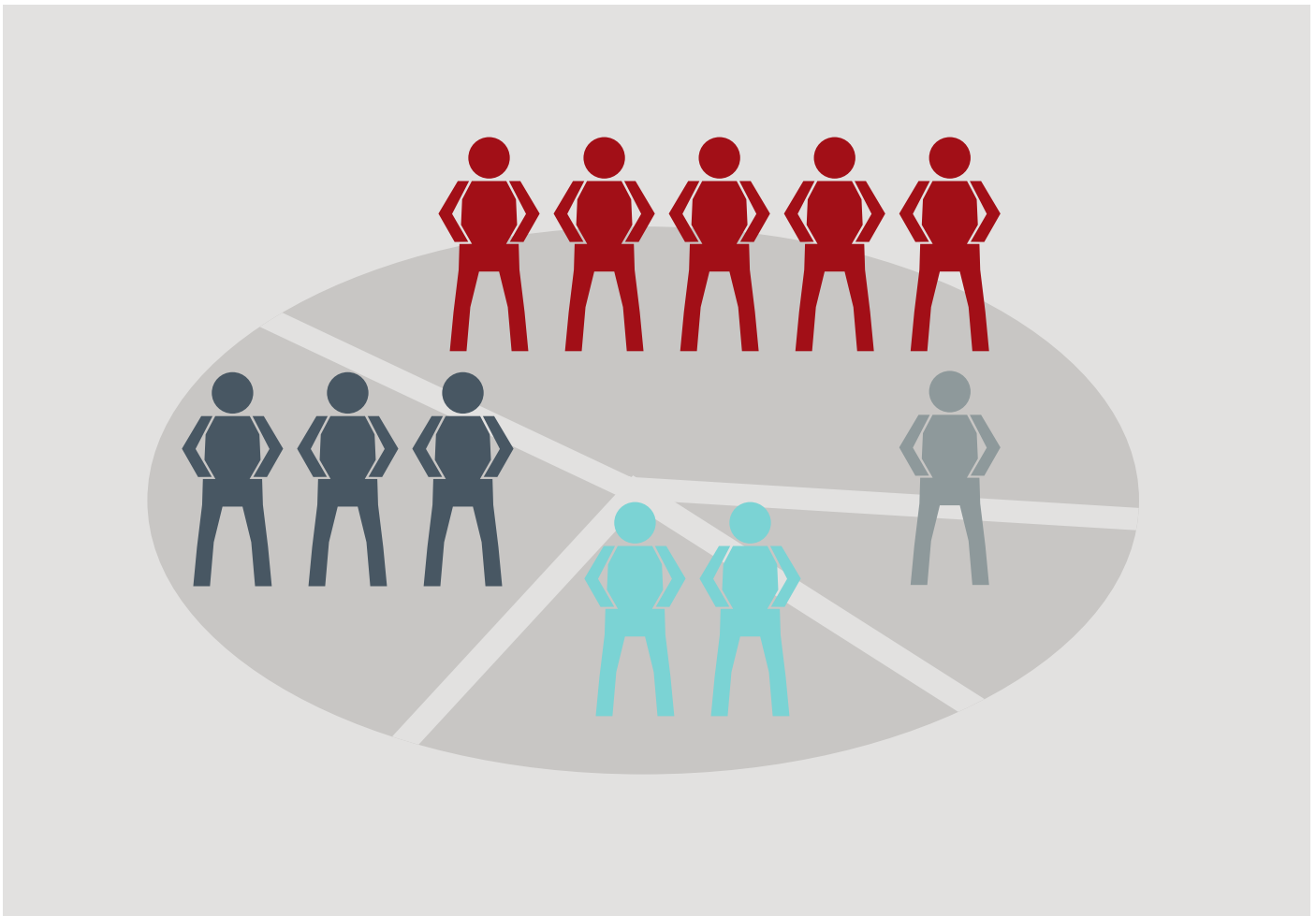
Denmark’s large-scale telehealth projects have made it clear that the terminology and description of data in relation to telehealth device readings are very important for clinical professionals working with telehealth data.

This type of information is standardized by using the HL7 Personal Health Monitoring Report standard (HL7 PHMR), which reports data about the health status of a patient measured by clinical devices such as weighing scales, blood pressure monitors, glucometers, pulse oximeters, etc.

Denmark has also established a national telehealth database, which is accessible to hospitals, GPs and municipalities – and is compatible with electronic health records (EHRs).

The large-scale implementation of home monitoring presented a good opportunity to put the national telehealth architecture to the test. Based on three years of data, test runs have resulted in TRL +7 score on the Technology Readiness Level scale (a nine-level maturity indicator developed by NASA).

A national public governance organisation, which collaborates with private enterprises, has created a national infrastructure, including common standards for telehealth data, in just five years. Denmark now has a robust framework to implement telehealth nationwide. This infrastructure will be further tested and improved during the coming years.



Compliance and prevention

● For the past 10-15 years, Danish healthcare policies have given increasing priority to prevention and public health efforts. In the future, telehealth solutions may play an important role in promoting healthier lifestyles, diagnosing diseases earlier and ensuring compliance with treatment.

Since Denmark's public administration reform in 2007, a new focus on population health and prevention has played an increasingly important role in national and local health policies.

In the future, telehealth solutions will make a valuable contribution to these efforts.

Telehealth engages citizens in their own health in a different way than traditional healthcare services. It increases their awareness of risk factors and facilitates close co-operation with providers and professionals within the healthcare system.

This is not just a matter of providing patients with basic health information. Citizens need information that is immediately relevant, empowering and tailored to their individual needs, giving them the tools to engage in their own health management.

“Telehealth engages citizens in their own health in a different way than traditional healthcare services. It increases their awareness of risk factors and facilitates close co-operation with providers and professionals within the healthcare system.”

Telehealth will be an important instrument in ensuring patients' compliance with their treatment or rehabilitation programmes. For

patients with one or more chronic illnesses, telehealth technology may make their everyday lives easier because monitoring, treatment and rehabilitation does not involve frequent outpatient visits.

Integrating telehealth solutions into population health management programmes may also reduce the amount of costly interventions, emergency department visits, hospitalisations, imaging tests and surgery, with obvious benefits to the healthcare system as a whole.

In some fields, the application of telehealth solutions as part of public health programmes has significantly improved clinical outcomes and management of health.

Using telehealth solutions to improve population health

- In the Municipality of Esbjerg, a combined telehealth and prevention platform motivates chronic patients to comply with treatment and consider healthy lifestyles.

Esbjerg Municipality in the Region of Southern Denmark has taken a new approach to population health. With a health management platform combining telehealth and preventive services, it seeks to motivate chronic patients to adopt a healthy lifestyle, and improve their compliance with treatment.

Healthy citizens may access the platform through a website where they monitor their health situation and lifestyle. At-risk or chronic patients connect directly to healthcare professionals in the municipality for support, follow-up and feedback.

Using their own devices, such as smartphones, tablets or desktop computers, these patients connect to a telehealth service to monitor their condition at home or seek preventive services if needed.

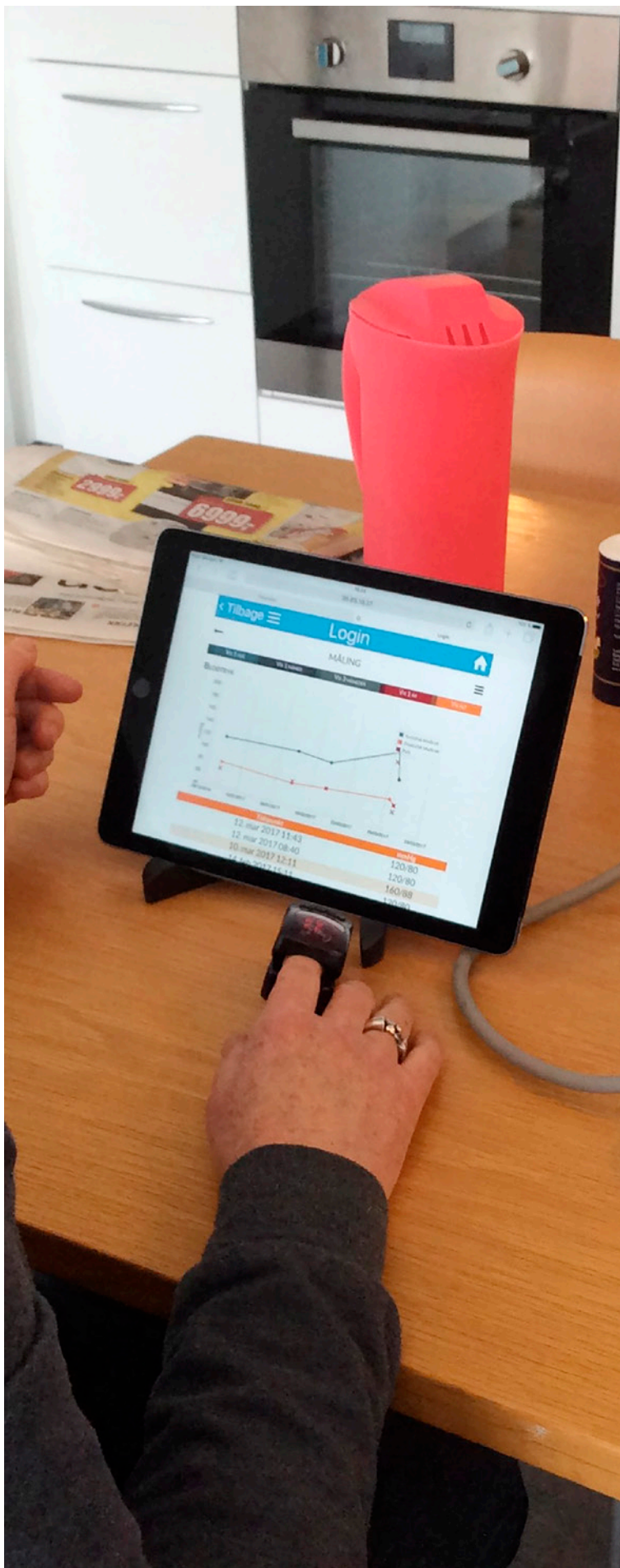
The interface also provides information and advice related to their individual health issues, in the form of short video guides or written information.

A tool for inspiration, motivation and understanding

Experience shows that the interface helps citizens visualise what is otherwise “invisible” and makes it easier for them to address their health issues. The use of a mobile device means that they always “bring” their data to any given location, and the connection between data and lifestyle makes it easier for them to act towards better compliance.

The platform has been launched with the intention of helping people to understand and manage their own health situation. It is designed to inspire them to set and achieve individual goals with regard to their health, and motivate them to comply with treatment.

“Addressing the health status of our citizens in a way that motivates them to adopt a healthy lifestyle is our primary concern. A healthy lifestyle and compliance with treatment help prevent new diseases and ensure faster rehabilitation for our patients,” says Arne Nikolaisen, Healthcare Executive at Esbjerg Municipality.





Telehealth facilitates early detection of hypertension

● **Telehealth solutions may facilitate the early diagnosis of hypertension. A clinical study in the Municipality of Holstebro documents that home measuring supported by telehealth technology may help eliminate reporting bias.**

Hypertension, or high blood pressure, is a global public health concern. Sometimes described as “the silent killer”, it is known to trigger heart conditions, strokes and kidney failure, and is a major cause of premature mortality and disability.

The World Health Organization (WHO) has set a goal to reduce hypertension by 25% by the year 2025.

In the Municipality of Holstebro in the Central Denmark Region, a clinical cross-sector study examined home blood pressure (HBP) measurements, transmitted using telehealth equipment, as a tool for early detection of hypertension and elimination of reporting bias. The detection of hypertension is associated

with some well-known problems relating to reporting bias: Blood pressure levels can be affected by the measuring process in itself, the surroundings and the awkwardness of the situation etc. Therefore, the “office blood pressure” measurement (taken in a clinical setting) is sometimes different to the “natural” blood pressure level. This has given rise to concepts like “masked hypertension” and “white-coat hypertension”, describing conditions where office blood pressure levels are lower or higher than home measurements.

All participants, and not just those with high office blood pressure, were asked to do their own HBP measurements. The data from the home measurements were automatically transmitted to their personal health record and were made accessible to healthcare professionals through the electronic clinical record systems.

The project revealed that 35% of the participants had untreated or insufficiently treated hypertension. One third of the participants aged 55-64 years were reported to have ab-

normally high HBP measurements and a quarter were reported to have either white-coat hypertension or masked hypertension.

It also showed that electronic transfer of home measurements to the GP’s electronic record system improved the quality of clinical documentation as well as the efficiency of monitoring and follow-ups by healthcare professionals.

It is the first large-scale project to completely eliminate the risk of reporting bias by using telehealth technology to disseminate blood pressure data.

The results clearly document the potential for using telehealth to identify patients with undiagnosed hypertension at an early stage, as well as patients that are treated based on an inaccurate diagnosis.



: A video capsule is used to diagnose patients in their own home. It collects images of the colon, which are later analyzed at a diagnostics center.

Innovative video capsule allows cancer diagnostics at home

● A new technology, supported by a telehealth solution, may significantly improve Denmark's screening programme for colon cancer. A "camera pill" allows patients to be diagnosed at home without the risks and discomforts of a colonoscopy. The project has shown remarkable results.

Since 2014, all Danish citizens between the age of 50 and 74 have the option of participating in a screening programme for colorectal cancer. So far, patients have had the choice between a colonoscopy, which is a highly accurate, but invasive procedure; and a stool test, which is non-invasive, but much less accurate.

The latter often results in false-positive results, which means that these patients have to undergo a colonoscopy anyway.

This has made many people reluctant to participate in the screening. To improve the participation level and accuracy of the programme, Odense University Hospital in the Region of Southern Denmark and national health authorities are testing a third alternative, a "camera-pill" technology.

The patient swallows a video capsule, which records its passage through the digestive system. This can be done in the patient's own home because the service is supported by a telehealth solution to control recordings and transfer images to a diagnostics centre.

"The patient swallows a video capsule, which records its passage through the digestive system. This can be done in the patient's own home because the service is supported by a telehealth solution to control recordings and transfer images to a diagnostics centre."

The procedure provides the same information as a colonoscopy, but with much lower risk and

discomfort to the patient. If tests reveal that the video technology is as reliable and cost-effective as expected, it has the potential to significantly increase participation in the screening programme – improving clinical outcomes and survival rates.

A comparative pilot study from 2016, involving 250 citizens from the national screening programme, showed remarkable results. The video capsule detected twice as many abnormalities as a colonoscopy, showed no signs of technical difficulties or instabilities – and caused much less patient discomfort.

A larger clinical project with 3,000 participants will aim to validate these results.

Other hospitals are now implementing the video capsule solution based on Odense University Hospital's experience.

At the same time, Danish health authorities are taking the initial steps towards defining the conditions for future implementation in the national screening service.

Denmark – a telehealth nation

- As the cases in this white paper show, Denmark is using telehealth successfully across sectors and geographical boundaries for the benefit of patients and professionals.

The success of these efforts can be attributed to different factors in the Danish approach to the use of telehealth:

Denmark has been working strategically with telehealth for years, for example through the National Action Plan for Dissemination of telemedicine during 2012-2015, and the national strategies for the digitization of the Danish healthcare sector.

Small- and large-scale telehealth projects are being carried out across the Danish healthcare sector. This provides the basis for trials, development and innovation in different fields of healthcare, which in turn lay the foundation for national dissemination of the most successful concepts.

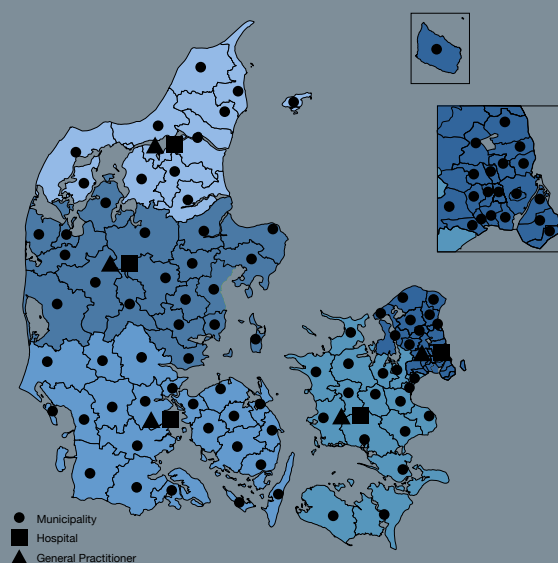
Denmark is a global frontrunner when it comes to the use of telehealth across sectors. Healthcare professionals in hospitals, municipalities and general practitioners collaborate to provide cohesive treatment for the benefit of patients throughout the country. The TeleCare North project and the concept of Home-based ulcer treatment are examples of this.

Telehealth is not just about implementing new technologies. Preparing the organisation is equally important, and telehealth implementation often acts as a catalyst for changing routines and workflows. This is vital to realising the benefits of telehealth for the patient. In the Chemo at Home project, a redesigned workflow gave patients higher quality treatment without increased expenditure and reduced the average number of inpatient days, freeing up beds and staff resources.

Furthermore, telehealth gives patients access to their own electronic healthcare data, which are available through telehealth solutions and the national infrastructure. This empowers patients, making it easier for them to gain insight into their condition and play a more proactive role in their own healthcare. In TeleCare North, COPD patients' ability to respond to early signs of deterioration has increased their confidence and level of self-management.

Denmark will continue to prioritise the use of telehealth solutions in the future, with the ambition that even more patient groups and healthcare professionals should benefit from telehealth.

If you want more information on telehealth in Denmark or the next generation of telehealth innovation, feel free to contact Healthcare DENMARK. If you want to visit Denmark and examine the innovative telehealth solutions presented in this white paper, you can request a delegation visit through the Healthcare DENMARK website.



● The telemedical map – telehealth projects in Denmark

The purpose of the telemedical map is to contribute to a common overview of the telemedical initiatives in Denmark and to provide a basis for knowledge sharing and cooperation across regions and sectors. The map provides easy access to knowledge about telemedical experiences within the Danish healthcare system.

The telemedical map is aimed at both decision makers, project managers and clinicians.

About Healthcare DENMARK

Healthcare DENMARK is the international gateway to Danish healthcare expertise and innovation. Our aim as a non-profit public-private partnership is to internationally benchmark Danish best practices within healthcare.

The goal of Healthcare DENMARK is not to sell or promote any specific products or solutions,



• Hans Erik Henriksen
Chief Executive Officer

but to communicate the strongholds of Danish healthcare. We do this by attracting health politicians, decision-makers, and journalists to experience Danish healthcare solutions in practice and meet the people

behind. Our network is an extensive pool of public sector, private companies, and other actors in the area of healthcare – all dedicated to providing excellent and efficient healthcare as well as sharing best practices across borders and professions.

“In Denmark our focus on putting the patient first – combined with efforts to improve efficiency and quality – has resulted in a wide array of innovative solutions. I sincerely believe Danish solutions and expertise can have a positive impact on global health.” - Her Royal Highness Crown Princess Mary of Denmark

If you would like to learn more about our world-renowned healthcare, we can assist you with tailoring a visiting program, setting up meetings, and arranging access to otherwise off-limits areas and people within both the public and private sectors, as well as assist



• HRH Crown Princess Mary of Denmark
patron of Healthcare DENMARK

you with local accommodation and transportation.

Healthcare DENMARK has a national and political mandate to provide this service to politicians, relevant top and management level professionals, and journalists working with healthcare.

Backing this public-private initiative is a partner group of both public and private key actors within Danish healthcare, including the Ministry of Health, the Ministry of Foreign Affairs of Denmark, the Ministry of Industry, Business & Financial Affairs, Danish Regions, Region of Southern Denmark, the Confederation of Danish Industry, the Confederation of Danish Enterprise, Falck, KMD, Systematic, OpenTeleHealth, Intelligent Systems, Danish Export Association, Lyngsoe Systems, Wavecare, Danish.Care, and PDC.

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