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HEALTHCARE DENMARK

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Innovating health and assistive care in Denmark



Forewords

Like many other countries, Denmark is facing major demographic changes in the coming years. We are witnessing a growing senior population, and by 2050, we estimate that the number of citizens aged 80 or above will increase by 300,000 individuals.

The fact that we live longer lives is of course wonderful news. It also, however, presents us with a challenge in providing adequate care for those who need it. By 2035, we may expect a shortage of 14,500 care workers in Denmark. One of the solutions to this challenge includes technology.

Technological developments are booming in many fields, and I see great potential in applying tech solutions also to the welfare sector. Many well-documented tech solutions in this field are already at hand – what we need is to expand and scale their use and encourage the development of more such.

The potential is promising. When applied smartly, tech solutions may both help improve the quality of life and individual freedom for our senior citizens, and, at the same time, optimise work conditions for our care workers.

In addition, assistive technology poses unique opportunities for Danish companies.



As one of the world's most digitalised countries, Denmark has the opportunity to take a leading position in developing assistive technology. The Danish government supports innovative thinking in the field, including establishing public-private partnerships to join efforts in the development of smart innovative solutions.

Technology has much to offer, now and in the future. When done wisely, the implementation of assistive technologies has the potential to become a win-win-win situation – for the elderly, for the employees and for our society.

Mette Kierkgaard
Minister for Senior Citizens

Upholding the standard of prevention and patient care within our healthcare system is our utmost priority. With an ageing population and advancements in treatment, the number of Danes requiring care is rising steadily.

Innovative digital solutions can improve patient care and free up resources in a healthcare system with a growing number of patients. Health and assistive technologies can enhance the excellence of treatment in our healthcare system. Integrating innovative technologies in healthcare not only alleviates the strain on our system, it also presents an opportunity to transform our perspective on well-being.

We have a long tradition of supporting health innovation through public-private partnerships. Health and assistive technologies offer a range of benefits across medical, administrative, and societal levels.

From enabling remote care through telemedicine to empowering individuals with data-driven insights through wearable devices, these technologies can resolve geographical constraints and improve access to health care.

Furthermore, integrating artificial intelligence and advanced data analytics holds potential beyond immediate access to care, enhancing diagnostic precision,



personalizing treatments, and optimizing resource allocation.

In light of the challenges we face, our capacity to foster innovation and to develop, implement, and scale new solutions will be pivotal to advancing healthcare and providing optimal patient care in the future.

I trust that this report will offer inspiring insights into the nature of health innovation underway in Denmark, contributing to the development and fortification of robust healthcare systems worldwide.

Sophie Løhde
Minister for the Interior and Health

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Introduction

In the coming years, Denmark's healthcare system will undergo significant transformations due to an ageing population, a rise in the number of people living with chronic diseases, and an increasing need for healthcare professionals.

As these challenges rise, strategic development of assistive health technologies becomes crucial. Assistive and health technologies aim to improve the quality of life and independence of individuals in need of help, with disabilities or chronic conditions.

In Denmark, we have a long-standing commitment to social welfare and healthcare accessibility which is built on inclusion, autonomy, and societal participation. This involves a collaborative effort from healthcare professionals, researchers, companies, and users to identify needs and innovate solutions.

Assistive technology is the technological support and reinforcement of comfort, safety, daily tasks, and mobility in everyday life. It is primarily aimed at elderly people, individuals with chronic diseases, and citizens with disabilities of various forms and degrees

Assistive and health technologies

are user-focused technologies that supply or assist the user with one or more welfare services.

Denmark's advanced digital infrastructure and its population's ease with technology strongly support the implementation of assistive and digital health technologies as they advance and evolve over time.

These innovations help address labour shortage and drive the delivery of care and healthcare services in home settings. This also supports a political ambition for ageing in place and is a part of an integrated care model.

Integrated care revolves around coordinating healthcare services across multiple providers to ensure the delivery of high-quality, patient-centred care.

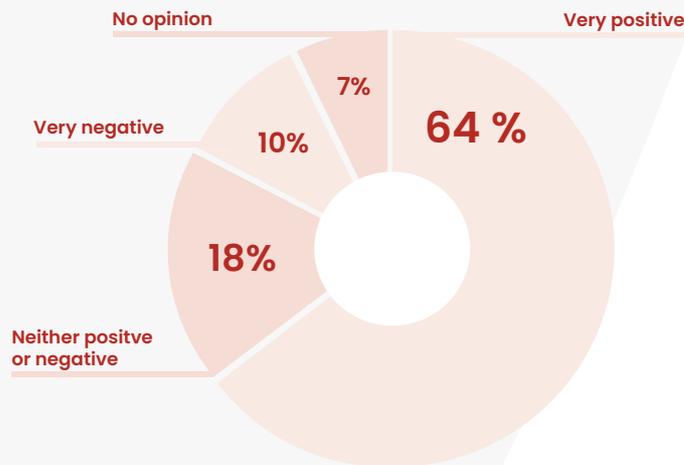
In Denmark, patient-centred care is already highly developed supported by our digital transformation in healthcare services. As new needs have arisen, the digitalisation has been developed and adjusted accordingly to meet the need for coordination across sectors.

This publication offers cases and background for the Danish approach to innovation and use of assistive and health technologies intending to create dialogue and share knowledge across borders.

With our digital healthcare system, Denmark enables efficient information sharing across healthcare providers, fostering high-level coordination and collaboration, especially critical for patients requiring care from multiple healthcare professionals.

The Danish population's disposition towards using digital healthcare solutions to receive assistance and treatment in their own homes¹

Next inevitable step which is being tested is providing treatment at home offering numerous advantages, such as delivering services at the lowest cost, reducing risk of readmission, increasing patient engagement and potentially help staffing challenges.



By 2030 there will be 41% more danes above 80 years old
(Source: Statistics Denmark)

The Danish healthcare system

offers universal health coverage with free and equal access to healthcare services, including psychiatric care, and is financed mainly by tax revenue (84%) with some smaller out-of-pocket payments, for example for dental services and medicine co-pay. The healthcare system is largely decentralised and divided into 5 regions and 98 municipalities, and is based on the individual's right to autonomy, with a free choice of hospital and general practitioner.



Strategies for the use of assistive and health technologies in Denmark

In Denmark, healthcare services are among the most digitised in the world due to a long tradition of focusing on implementing and integrating digital solutions. Workflows at hospitals, general practitioners, and municipal healthcare services are digitally supported. Initiatives for this integrated and digitally accessible healthcare system have been initiated from both national level and professionals working in the field.

The current Strategy for Digital Health in Denmark has been developed in collaboration between the government, Local Government Denmark, and Danish Regions. It aims to contribute to individuals experiencing the healthcare system as one safe and cohesive network that is digital by nature and human in its approach.

Besides the national strategy, most municipalities have formulated their own strategies for deploying assistive and health technologies. These typically align with local policies for elderly care. Since 2013, the drive to test and integrate these technologies has been rooted in the Centre for Assistive Technology under Local Government Denmark.

Furthermore, technology-related initiatives are now being centralised within the Innovation and Technology department in Local Government Denmark to promote cross-sectoral knowledge exchange in various fields of welfare.

Digital Health Strategy 2018–2024

In 2018, the ‘Coherent Health Network for All’ strategy boosted Denmark’s digital healthcare leadership. It prioritizes citizen-centric care and supports local and national initiatives, adapting to tech advances with 27 initiatives for a sustainable healthcare system by 2024.



CASE Local Government Denmark

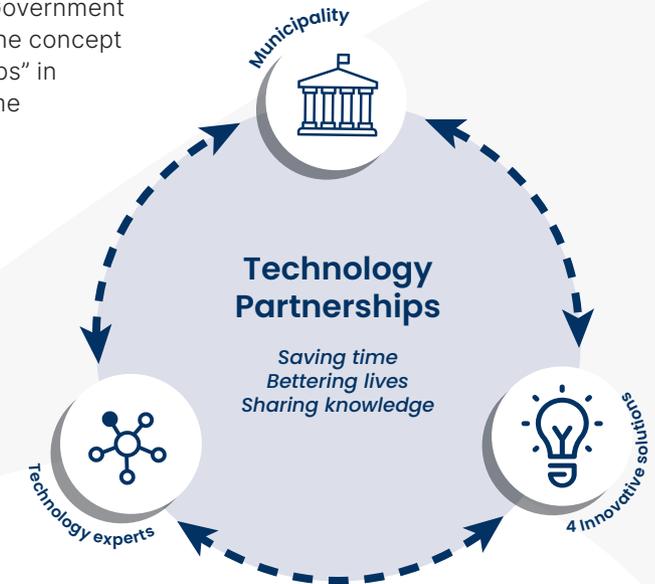
Expanding the digital transformation in Denmark

As a new initiative, Local Government Denmark has introduced the concept of “Technology partnerships” in 2023, a 1.5-year programme to expand the digital transformation in Danish municipalities.

Through support to adapt new technologies in the municipalities, the programme addresses challenges such as labour shortage and an increasing elderly population.

The partnership provides expertise in implementing proven technologies that save time and benefit the citizens. Focus areas include virtual visits within home care, digitally supported rehabilitation, and automation of administrative tasks.

The programme includes knowledge sharing with other participating municipalities and consultation with technology and implementation experts. It is targeted at municipalities ready to commit to implement innovative solutions the partnership is built on.



Working with innovation in Denmark

Innovation is fundamental to the Danish healthcare system but is only successful when fully implemented and actually helping and changing people's lives.

The Danish Government, research institutions, and private investors provide funding and support for innovation through funding programmes, grants, and initiatives which are available to foster research, development, and implementation of innovative solutions. Both Public-Private Partnerships (PPP) and Public-Private Innovation (PPI) play an important role in improving innovation within the sector.

It is crucial that healthcare professionals are involved in innovating the solutions, because they need to treat more patients with less staff.

At Bispebjerg and Frederiksberg Hospital, in the Capital Region of Denmark, they have established "Behovsfabrikken" which translates into "The factory of needs". There are similar initiatives supporting innovation in the other four regions in Denmark.

CO-PI

The Danish Government, Local Government Denmark, and Danish Regions founded CO-PI (the national centre for public-private sector innovation) as **a national hub to foster public sector innovation and facilitate collaborations with private companies.**

While CO-PI operates across multiple domains, its emphasis lies particularly on welfare-supporting technology. CO-PI plays a crucial role in boosting the public sector's innovation capabilities and its capacity to generate innovative solutions that yield societal benefits.

CASE *The Factory of Needs*

Capital Region of Denmark

The innovation unit at Bispebjerg and Frederiksberg Hospital tackles issues experienced by patients and staff. By prioritising the understanding of patients' needs and healthcare professionals' perspectives, it fosters the development of practical, problem-specific solutions. "Behovsfabrikken" engages with the staff to pinpoint issues and then searches for appropriate solutions.

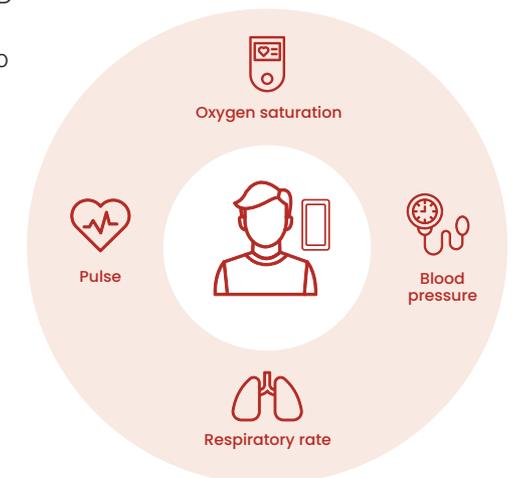
If a suitable solution is not already available, they issue a tender, inviting companies to collaborate closely with them at Bispebjerg Hospital to innovatively address the problem in a specific developed programme in cooperation with the company.

CASE WARD

Bispebjerg & Frederiksberg Hospital and Rigshospitalet

The Clinical Support System WARD 24/7 (*Wireless Assessment of Respiratory and circulatory Distress*) was set up by hospital doctors and engineers from the Technical University of Denmark. They needed a way to track the health status of patients in various parts of the hospital. Supported by the Innovation Fund Denmark, WARD 24/7 was created and has accordingly now established a spin-out company to pursue the regulatory and commercial goals in a public-private partnership with academic institutions.

The system displays status remotely to nurses' smartphones with alarms only in case of important deviations. It has been tested by nurses and also in patients' own home after hospitalisation where there is still a need for patient monitoring. This has shown very promising and clinically relevant results.



The solution is unique for monitoring vital signs (blood pressure, respiratory rate, oxygen saturation, etc.) both in hospital settings and in patients' own home. Advanced AI algorithms interpret vital sign patterns from standard wireless sensors and detect deterioration earlier and in real-time.

CASE Cervical cancer screening

Capital Region of Denmark

The Pathology Department at Amager and Hvidovre Hospital, part of Copenhagen University Hospitals, has since 2014 developed, validated, implemented and now operationalised HPV self-sampling as an alternative to the clinician collected samples that traditionally drives cervical cancer screening.

The development effort has included healthcare professional associations, patient organisations, the Danish Association of the Physically Disabled Persons, various healthcare and public stakeholders, and multiple private companies, all together creating a successful Public-Private Innovation (PPI).

The PPI has led to an at-home HPV testing solution targeting women who do not participate in standard screening programmes. This novel approach uses advanced technology and medical research to allow individuals to test for HPV infections at home. The implementation of this home-based testing has increased HPV screening rates, enhancing early detection, and significantly boosting the efficacy of cervical cancer prevention initiatives in the Capital Region of Denmark.

The Capital Region of Denmark invites **50,000 women annually** to take the HPV home test, of which **20% accepts the offer** (opt-in model).

The home test contributes to the cervical cancer prevention by identifying approx. 100 women who needs treatment every year, **preventing 8-13 cases of cancers annually**. **Every year, 4-5 women are directly diagnosed with cancer after a home test.**

CASE Nordic Health Lab

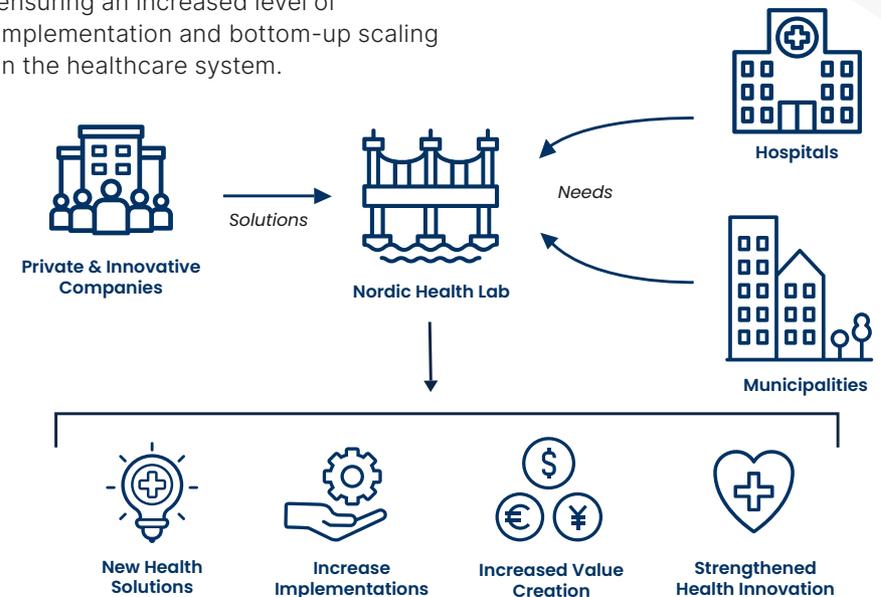
Cross-regional and cross-sectoral partnerships

Nordic Health Lab is actively bridging the gap between Small and Medium-sized Enterprises (SMEs), offering innovative solutions to the Danish public healthcare system. Through formal partnerships with hospitals and municipalities, as well as a transparent and efficient single-entry point for SME solutions, Nordic Health Lab oversees an increasing number of successful test-runs of innovative healthcare solutions.

In cross-regional and cross-sectoral partnerships, Nordic Health Lab ensures that the right (need based) solutions are tested and documented ensuring an increased level of implementation and bottom-up scaling in the healthcare system.

Nordic Health Lab focuses on the entire process, which ranges from identifying the needs in hospitals and municipalities, screening and matching SMEs, preparing them, facilitating the test, and applying a robust and transparent evaluation method that documents the solution's value and potentials.

Thereby, Nordic Health Lab plays a significant role in accelerating new assistive and health technologies improving the quality of work and health for healthcare professionals and patients in Denmark and around the globe.



Implementation and adaptation

While there is significant emphasis on developing innovative solutions, there has been less attention given to implementing and adopting these effectively.

To meet the challenges in this area, there is a continuous need for management focus and user involvement. In the Danish healthcare system, there is a strong tradition for recognising the value of engaging users, including patients, healthcare professionals, and citizens in decision-making processes, policy development, and service improvement initiatives.

This approach ensures that healthcare services are tailored to meet the diverse needs and preferences of the population.

As an example, Danish municipalities have been working on testing and implementing technologies in the areas of elderly care, disability, and health. The overall goal of introducing technologies in these areas is to improve the quality experienced by the citizens, the working environment for healthcare professionals, and streamline tasks and thus generating resource savings.

CATCH project

employs the 'cardio-share' model for remote collaboration between cardiologists and primary care practitioners, which has been proven successful in guiding general practitioners (GPs). **With support from Innovation Fund Denmark, researchers are currently assessing its effectiveness in the treatment of heart failure patients.**

Cardiologists offer video meetings with GPs, caregivers, and relatives before the patients' discharge, followed by remote support from cardiologists on-demand. This innovative approach aims to **support patients' treatment in the primary care sector** rather than in hospitals.

CASE *Virtual visits in home care*

Viborg Municipality, Central Denmark Region

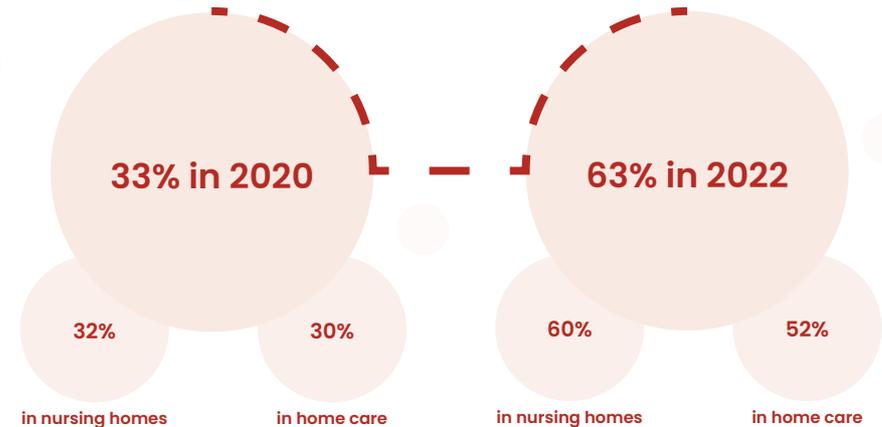
Viborg Municipality has successfully implemented virtual visits in their home care services, transforming the way citizens receive assistance. By offering an alternative to traditional home visits, virtual visits have empowered citizens, giving them a sense of control over their lives.

These virtual visits are regularly complemented by physical visits, allowing healthcare professionals to gain a broader understanding of the citizens' well-being.

Viborg Municipality has overcome challenges by taking ownership of the implementation process and fostering a culture of adaptability.

They have succeeded with this by emphasising the importance of maintaining human interaction in caregiving while implementing the technology in the care. Their experience underscores the need for user-friendly technology from Atea, digital skills, and ongoing dialogue to optimise digital innovations in home care.

Survey shows an increase in municipalities that have or are currently incorporating virtual visits¹



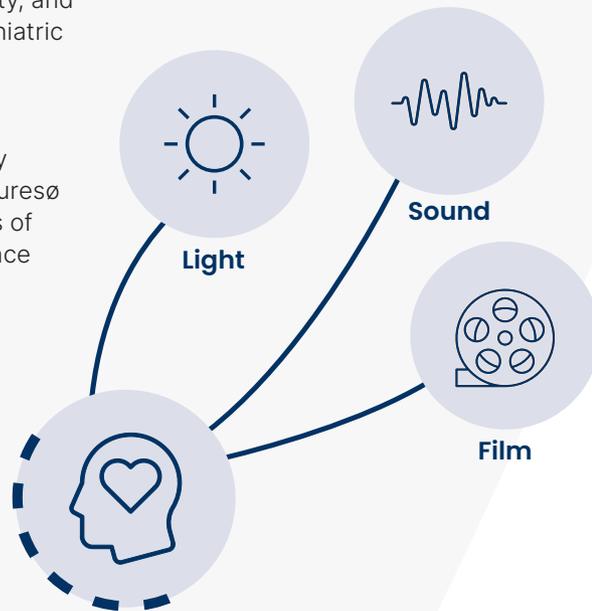
CASE Sensory stimulation technology

Interdisciplinary approach to sensory stimulation in Furesø Municipality

Wavecare provides sensory technology involving film, sound, and light to create positive sensory experiences and support care and safety in challenging situations. The technology has demonstrated positive results in addressing restlessness, anxiety, and unresponsive behavior in psychiatric patients.

Wavecare is currently testing and implementing their sensory technology in a care home in Furesø municipality. The primary focus of this implementation is to enhance the professional knowledge of care staff in utilising sensory stimulation as an assistive technology, which leads to improved care and creates a more harmonious work environment with reduced conflicts.

By incorporating sensory stimulation as an interdisciplinary tool, it is anticipated that residents' daily lives and well-being will be enhanced, thus benefiting both the residents and the staff.



CASE Centre for digital psychiatry

Easy and equal access to mental health

The Centre for Digital Psychiatry has been established to develop, test, research, and implement digital solutions that ensure all Danish citizens have easy and equal access to mental health.

This is achieved by matching current needs in psychiatry with relevant digital technologies. The Centre is a part of Psychiatry in the Region of Southern Denmark and collaborates with the departments in the hospitals on the development and adoption of digital solutions. It also drives development and research projects in collaboration with universities, companies, authorities, and the rest of the healthcare system.

I have gained a better understanding of my anxiety and learned that I am not my thoughts. This allows me to act on what I want, instead of what my anxiety tells me.

Young person after using Mindhelper

Additionally, the centre operates and further develops several nationwide digital services. An example of this is Mindhelper, an online service for young people who are struggling. At Mindhelper.dk, young people can gain knowledge and advice on everything from heartbreak and loneliness to anxiety and depression.

The aim is to enhance the general mental well-being of the youth by developing materials that teachers can use to spotlight mental health in the curriculum of schools and youth education programmes.

More than 1.1 million visitors in 2022

9 out of 10 visitors report that mindhelper.dk was helpful to them

Over 45 % of users are 30 years old or younger

(Source: Mindhelper)

Scaling

Scaling refers to the process of making assistive and health technologies more widely available and accessible to healthcare staff, patients, and citizens. Ensuring that assistive technologies are distributed effectively is an important aspect of scaling.

This can involve partnering with organisations that work with people with disabilities, establishing new distribution channels, or developing online platforms to make it easier for people to access these technologies.

To ensure innovation, diffusion, and scaling of technological solutions in the healthcare system, a strong organisational framework is needed. This framework involves a systematic approach to development and implementation, allowing time for organisational growth and usability enhancement. It emphasises data presentation for quality improvement and treatment, supported by appointing innovation and implementation leaders.

Scaling is a challenge

A perspective from Danish Care – trade association for assistive technology

The Danish trade association for assistive technology and local companies specialising in assistive, care and health technologies acknowledge the challenges in scaling technologies and transitioning from pilot projects to large-scale purchases.

Despite Denmark's strong foundation in these technologies, a decentralised healthcare system involving five regions and 98 municipalities poses challenges to scaling new innovative solutions.

While many municipalities and regions actively engage with these technologies and test solutions, large-scale purchases and widespread implementation rarely result. Therefore, the trade association advocates for a national approach to scale and increase interregional collaboration and has urged equal emphasis on both innovating new solutions and successfully implementing existing, tested ones.

CASE CO-PI

The Centre for Public-Private Innovation

Annually, the Danish public sector allocates approximately 400 billion DKK for the procurement of goods and services. There is significant untapped potential for public procurement to become a catalyst for innovation. To harness this potential, the Danish Government established the Centre for Public-Private Innovation (CO-PI) and introduced an approach known as “scaling processes.”

In CO-PI's scaling processes, multiple public organisations collaborate to address common challenges that the private market has not yet adequately addressed. By pooling their efforts, the public sector creates a substantial

collective demand, incentivising private companies to expedite the development of solutions to meet these needs. Notably, two out of four scaling processes within CO-PI have focused on time-saving welfare technology.

These scaling processes foster a continuous and structured dialogue between public and private stakeholders about problem solving.

Private entities operating in the market gain deeper insights into the challenges and requirements of public clients, while simultaneously, public stakeholders refine and align their expectations for innovative solutions.

“As a trade association for the industry, we would like to see more collaboration across the country, the industry, the ecosystem, and from a political standpoint. With a joint approach we can far better and more efficiently implement the solid Danish solutions in the health and care sectors, and at long last reap the benefits of assistive and health technologies.”

Morten Rasmussen
CEO, Danish Care

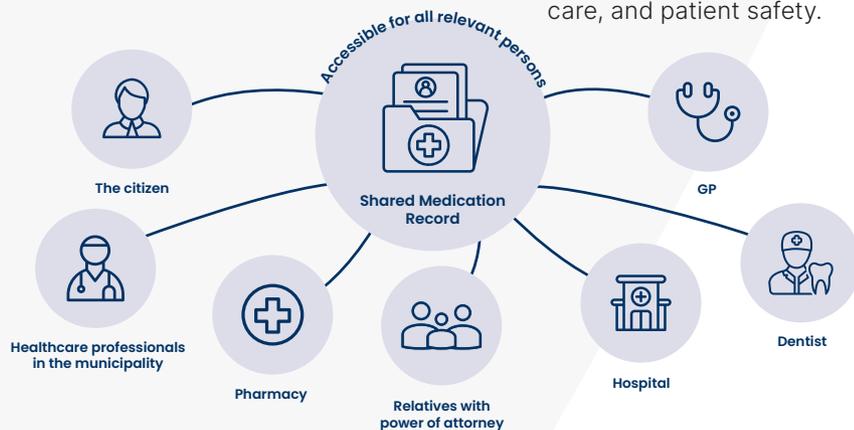
Efficient workflows

Efficient workflows and management are crucial elements in the Danish healthcare system, enabling healthcare organisations to optimise resource utilisation and deliver high-quality care. The advanced digital infrastructure in healthcare supports this by integrating local IT systems, providing healthcare staff with access to health information across sectors, and enabling the secure exchange of information between sectors.

The system faces challenges such as staff shortages and increasing patient demands, prompting the exploration of innovative solutions. Integration of electronic registration and tracking systems has streamlined processes, saving time for healthcare professionals and allowing them to focus on patient care – not only in our hospitals but also in our home care services.

In our hospitals, we strategically design our facilities, including the placement of equipment and furniture, to simplify the workflow for our healthcare staff. These improvements lead to better outcomes and experiences for patients because they allow healthcare providers to spend more time engaging in meaningful interactions and providing personalised care.

Continuous innovation and the pursuit of excellence are essential for maintaining efficient workflows in the Danish healthcare system. In Denmark, we aim to share relevant health data across different levels and sectors to enhance and optimise our healthcare system. The most clear example is the shared medication record which is a centralised database that allows healthcare providers to access and update a patient’s medication information, enhancing coordination of care, and patient safety.



CASE Smoother workflows with mobile communication platform

Developed in a public-private partnership

Columna Flow Clinical Tasking, a mobile communication platform, has been developed in public-private partnership between Systematic and physicians from the emergency department at Aalborg University Hospital.

The solution reduces pressure and improve coordination in their fast-pace environment by allowing clinicians to readily assess colleagues’ workloads and incoming patient information through the mobile application.

Tasks and area of responsibilities are reflected in real-time and are always tied to a patient. The result is smoother workflows, less stress, fewer calls, and an improved overview. Columna Flow Clinical Tasking offers a secure video and messaging platform, making it easy for clinicians to communicate about a patient. Using a check-in functionality gives clinicians a real-time overview of all colleagues on call as well as information about their current availability.

As a coordinating senior physician, I can already feel that the solution has provided me with a better overview of residents. At the same time, I get fewer phone calls because we can use the messaging functionality to quickly communicate with residents.

*Coordinating Senior Physician,
The Emergency Department at Aalborg University Hospital,
Denmark*

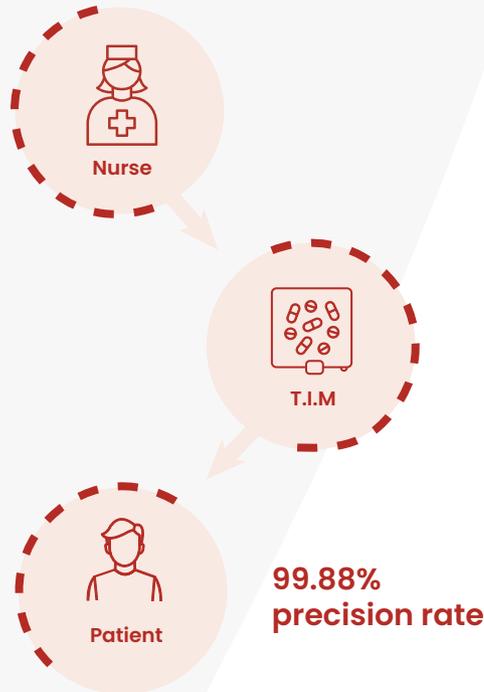
CASE Medication dispensing

Aalborg Municipality

In Denmark, physicians prescribe medication, while home care nurses are often responsible for administering medicine to elderly and fragile citizens who are unable to manage it themselves. This makes medication management a significant part of their duties. In response to this, the Aalborg Municipality developed the medication robot named TIM, designed to assist residents with precise medication dispensing.

TIM utilises data from care systems and health records to dispense the correct medication dosage, boasting an impressive precision rate of 99.88% since 2020 — higher than human capability. TIM's introduction has not only resulted in high user satisfaction but has also saved nurses approximately one hour per resident each week. This saved time can be reallocated to other tasks.

However, the project's expenses underscore the necessity for clear and continuous communication regarding TIM's function, benefits, role in supporting work, and its contribution to improving medication accuracy and fostering independence among residents.



CASE Time-saving technology

Streamlined and efficient home care experience

For home care providers, time is a crucial factor. Home care staff often face extra work and waste time due to phone and tablet charging challenges. The implementation of NoteLockers from Leba Innovation has solved this problem and increased efficiency at a private company delivering home care. NoteLockers ensure that work phones, tablets and PCs are always charged and ready for use. Employees save time and can focus on their tasks with fully charged devices.

This ensures seamless access to digital records and efficient service delivery.

NoteLockers have created a more streamlined and efficient home care experience. Employees can visit multiple residents per day without delays and always have access to important information. This contributes to an effective and reliable home care service.

CASE Efficient planning reduces staff turnover

Empowering staff to participate in planning

Danish hospitals face the task of both attracting and retaining physicians and nurses. One effective approach to enhance job appeal is by providing a work schedule that empowers staff to participate in planning and offers seamless shift change options.

To streamline operations and involve staff, PDC has developed PDC-Plan. This tool enables staff to request work or leisure time and facilitates shift exchanges among colleagues.

Collaborative staffing marks a significant stride towards efficient planning, resulting in longer employee tenures and a stronger workforce.

+200,000

Employee schedules are created using PDC-plan

Available in 8 languages

+50,000

Users of the employee app

2000 planners and 30,000 employees in largest installation

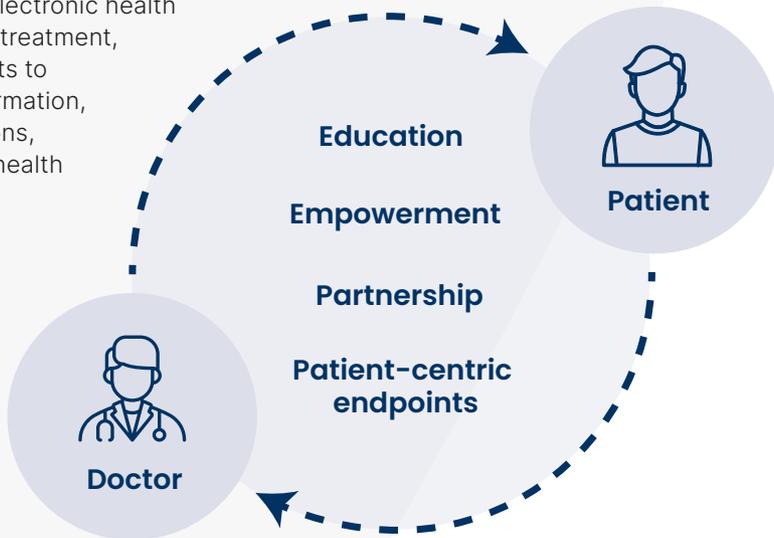
Empowerment and self-management

Denmark prioritises patient empowerment and self-management in healthcare, mirroring a global transition from doctor-centric to patient-centric models. This is evident in Denmark’s innovative hospital program, where design and structure serve to optimise patient experiences. The new hospitals aim to enhance patient care continuity, boost patient safety, improve efficiency and elevate quality.

This emphasis on patient empowerment spans from education about their conditions to shared decision-making with doctors, ensuring that treatment plans align with individual needs. It also includes the robust use of digital health technologies like electronic health records and home treatment, which allow patients to access health information, track their conditions, and manage their health independently.

Secure online access to personal health data enables self-management with tools such as home treatment, health tracking apps, self-screening tools, and wearable devices for monitoring health metrics.

Healthcare staff are trained to facilitate this empowerment, particularly through communication skills for shared decision-making. Patient associations, support groups, and national healthcare strategies also underline its significance. Through such initiatives, Denmark is empowering patients to improve health outcomes.



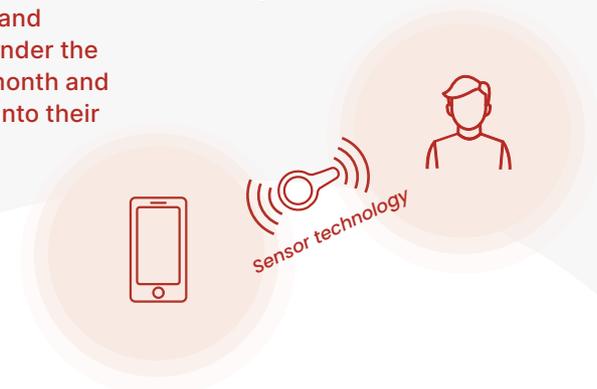
CASE Sensor technology help improve quality of life

Enhancing confidence and security of users

Through the first digital leakage notification system, Coloplast has developed Heylo. People with a stoma are for the first time empowered to have a digital notification on leakage which empowers them to live the life they want.

Heylo uses cutting-edge sensor technology embedded in the product’s layer to detect leaks under the stoma baseplate. Through an intuitive app, users receive prompt warnings of leaks, enhancing their confidence and security.

92%² worry about leakage and 76%³ experience leakage under the baseplate at least once a month and 26%⁴ experience leakage onto their clothes in the last month.



If we can address the fear of leakage for our patients, not only will this improve their quality of life but it will improve nurse practice, freeing up time to discuss other things with that patient in the clinic or to see other patients within that free time.

Tracey Virgin-Elliston
Lead Nurse Specialist Stoma Care, UK

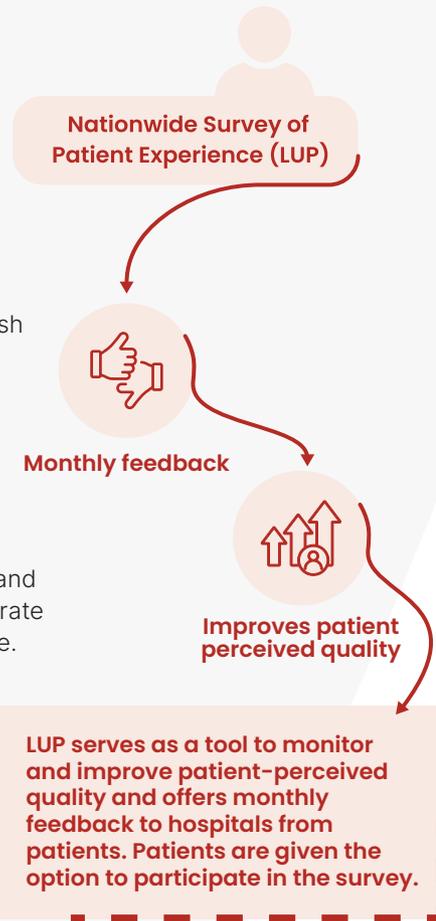
CASE The Centre for Patient Involvement (CPI)

Patient-perceived quality

The Centre for Patient Involvement (CPI) promotes patient involvement in the healthcare sector through counselling and evaluations.

This includes the Nationwide Survey of Patient Experiences (LUP), which assesses patients' experiences and satisfaction in Danish hospitals. CPI enhances learning about best practices for patient involvement across hospitals and advocates for the systematic engagement of patients and their families.

This fosters a more patient-centred healthcare system. CPI provides implementation support, feedback sessions, and mapping of patient pathways. They also integrate data on patient-perceived quality into practice.



CASE Prevention of dehydration and alleviation of workload

AQUATIME and ABENA Nova have entered a strategic partnership to address dehydration and incontinence in older adults, a critical issue given that up to 500,000⁵ Danes suffer from incontinence, and the prevalence increases with age. AQUATIME's intelligent drinking glass collects data on drinking habits

to prevent dehydration, while ABENA Nova's incontinence diapers utilise wireless sensors for real-time data and personalised care. This partnership combines innovative technological solutions to improve the quality of life for older adults and alleviate the workload of healthcare personnel.

CASE Fostering independence and coherence

Through IBG (Interactive Citizens Guide), individuals of all ages, genders, backgrounds, and abilities are empowered by a comprehensive communication tool for individuals, consolidating all necessary information in a single location.

Accessible via smartphones or tablets, IBG provides task overviews. It promotes predictability, safety, structure, and user empowerment, fostering independence and coherence.

Citizens can access the system through an interactive screen or an app. It centralises essential information, boosting communication, self-management, and user engagement — especially aiding those with cognitive challenges. IBG offers features such as work schedules, meal planning, activity coordination, and task structures accessible to staff and users' relatives.



Artificial intelligence (AI)

Denmark is at the forefront of integrating AI into healthcare, with specific research and innovation centres established across the country, focusing on AI's clinical applications.

Denmark's extensive digital infrastructure and comprehensive healthcare data make it a global leader in this field, offering significant untapped potential for data-driven technology. This potential opens doors for AI and digital assistance, which are increasingly important in addressing the challenges of future healthcare, particularly in the context of demographic shifts.

Notably, Denmark's Resilience Commission has recognised the potential of AI technology to improve healthcare. The Commission specifically recommends increased AI usage for diagnostics. **AI's potential is being explored through various applications, such as aiding emergency service professionals in quickly identifying stroke patients and assisting doctors in interpreting scans, ultimately leading to more accurate and early diagnoses.**

This not only results in better patient outcomes but also contributes to alleviating labor shortages and reducing costs.

However, the journey to fully integrate AI into healthcare comes with challenges. These include ensuring patient data security, addressing potential AI algorithm biases, and adapting to changes in job roles due to automation. Nevertheless, Denmark's robust digital infrastructure, high-quality healthcare system, and commitment to innovation position the country well for harnessing AI's vast potential in healthcare.

CASE AI monitoring helps care staff and enhance patient quality

Teton has pioneered an AI-driven platform, Teton One, designed to streamline tasks and bolster care staff's situational awareness and sense of security by employing AI-based sensors.

The platform contains capabilities such as automated monitoring, fall prevention and detection, documentation, and analysis of sleep-wake cycles. Teton's primary goal is to alleviate the burden on care staff, allowing them to concentrate more on direct patient care, reducing burnout risk, and mitigating the likelihood of adverse patient outcomes.

The platform uses a technology known as computer vision, wherein an embedded computer within the sensor comprehends visual data and conveys this information to the staff as small figures.

Instead of a plethora of highly specific devices and sensors assigned to monitor various room activities, this technology offers versatility, allowing the sensor to fulfil multiple roles simultaneously, while securing privacy for the patient.

CASE Identifying cardiac arrest using AI

Identifying cardiac arrest (CA) during emergency calls is crucial for prioritisation and for providing quick and effective care. This task is challenging even for experienced medical dispatchers. AI can assist in this process.

AI-technology is an AI model that rapidly and efficiently identifies CA during live emergency calls and has been developed, tested, and subsequently implemented in Denmark.

This public-private partnership project surpassed human dispatchers, winning the 2020 Public Innovation Award, and is now being used in other EMS systems.

The initial partnership included the University of Copenhagen, Emergency Medical Services in Copenhagen, and Corti AI. Falck is currently exploring the potential of AI in other emergency settings with various EMS systems and research groups.

Telemedicine

In Denmark, telemedicine is increasingly being used to provide remote healthcare services. In this publication, we use the term "home treatment" to describe telemedicine solutions.

Home treatment offers improved accessibility, convenience, and efficiency by allowing patients to receive medical consultations and treatments from their own homes. Home treatment provides citizens with tools to better understand their illness.

This empowers them to act more quickly when they notice changes in symptoms and also helps reduce their anxiety. The Danish Health Authority and private home treatment providers facilitate the implementation of home treatment initiatives in Denmark.

In the North Denmark Region, approximately 700 citizens with COPD receive home treatment/telemedicine

Telemedicine/ home treatment

is a health service performed using information and communication technology, whereby the patient and the healthcare professional providing the service become independent of a physical meeting⁶.

An example of that is TeleCare Nord COPD, a service in the North Denmark Region to provide a permanent home monitoring service to support patients with COPD in collaboration between hospitals, municipalities, and GPs. The service is currently being expanded nationwide.

However, challenges such as data privacy, reimbursement, equitable access, and integration with existing healthcare systems need to be carefully taken into account.

CASE E-Hospital

Region Zealand

Denmark's Region Zealand has taken an innovative and significant step by introducing the E-hospital. This allows citizens to receive treatment and expert guidance without leaving their homes or by visiting closer satellite locations. It is important to note that this digital avenue is pursued only when patient safety is guaranteed, emphasising the responsible integration of technology into healthcare.

The advantages for patients are substantial since they can now access essential medical guidance and treatments irrespective of their location.

This transformative approach has yielded remarkable results, notably enhancing both the quality and safety of healthcare services for patients while simultaneously reducing the need for acute hospitalisations.

This shift towards virtual care has also highlighted the need for a dynamic partnership between the hospital and primary healthcare. This collaboration is especially crucial in delivering tailored treatments to individuals at or closer to their homes. By combining cutting-edge technology with patient-centric care, this initiative exemplifies a modern and holistic approach to medical services.

This serves as a prime example of how emerging technologies can bridge the gap between healthcare services and citizens, ensuring that individuals feel a sense of proximity to these services.

Sophie Løhde

Minister for the Interior and Health

CASE Improving home-based rehabilitation

Sensor-based training and a user-friendly app

Icura is a home treatment solution dedicated to improving home-based physical activity and exercise, recognising the crucial role of exercise for patients in post-hospitalisation recovery and chronic illness treatment.

Through sensor-based training and a user-friendly app, Icura guides and motivates patients towards integrating physical activity and training in their daily life. By measuring specific parameters and everyday activities and sending the data to the therapist, Icura provides valuable insights for both patients and therapists.

Therapists benefit from time-saving features and the ability to offer flexible, individualised services, while patients receive effective exercise guidance.



With successful implementation in 25 Danish municipalities and hospital-based clinical projects, Icura is at the forefront of transforming healthcare delivery.

CASE Tele-homecare for premature babies and their families

Region of Southern Denmark

Odense University Hospital (OUH) offers a unique telemedicine solution for premature babies and their families that allows them to be admitted to their own homes instead of spending weeks in the hospital.

Premature children are monitored by hospital specialists until the original due date, but at OUH this time can be spent in the home supported by teleconsultations between the home and hospital.

Before being discharged for the in-home admission, parents are instructed on how to feed, weigh and measure the growth of the child and how to use the hospital app to send data to the staff twice a week before a video consultation with a nurse.

By simply connecting to the neonatal department through an iPad, premature babies and their parents can safely be discharged from the hospital while still receiving the necessary clinical assistance in the safe surroundings of their own home. This telemedicine solution enhances parents' confidence and ability to care for their child's needs while allowing the family to be together in their own home.



Education

Upcoming healthcare challenges need to be addressed as part of the education of healthcare professionals. This involves providing them with the necessary skills to effectively use and incorporate technological advancements.

These competencies are vital for overcoming the dual demographic obstacle confronting our healthcare system, an increase in patients coupled with a declining workforce entering the job market.

To account for these challenges, it is crucial that universities and educational institutions design their courses and teaching methods in a manner that enables future healthcare professionals to not only become more proficient in utilising emerging technologies in

medical care and treatment, but also fosters their capacity for innovation and curiosity in the development and application of novel solutions.

Another option is to use technology to simulate situations that healthcare professionals will encounter when they enter practice. This could, for example, involve practicing the handling of an agitated patient in psychiatry.

The healthcare system can potentially save two-thirds of the current expenses associated with diagnosing and treating melanomas (skin cancer) by dermatologists, plastic surgeons, and pathologists, using the app.

Niels Kvorning,
CEO in Melatech and inventor of Dermloop

The Dermloop app being tested and used in 3 out of 5 Danish regions, revolutionises skin diagnostics with AI-augmented training and clinical feedback. **It standardises training for doctors, e.g., the GPs who have few cases, and enhances diagnostic accuracy** because the Dermloop app enables seamless sharing of patient data and images, facilitating direct communication between GPs and pathologists for feedback and collaboration.

This approach boosts efficiency, reducing unnecessary procedures, waiting times, and resource consumption. **It has the potential to shift skin diagnostics to primary healthcare settings, advancing innovation and improving patient care.**

CASE UCL University College

UCL University College has implemented “Educations 4.0”.

UCL University College has experimented with new methods and implemented “Educations 4.0”.

The programme’s core belief is that the digital innovations currently reshaping society will similarly transform how education is delivered in the future. The programme aims to actively explore how these technological advances can impact education, identifying both the potential benefits and challenges they bring.

The point being that the content and ideas should come from the bottom up, students, teachers etc. The testing programme runs from 2022-2025 where teachers, students, and researchers will develop and test a wide range of ideas and new educational experiments in future education. Also making the students comfortable with and experienced in using technology. The programme will be evaluated and published to relevant education stakeholders in Denmark.

CASE Dementia simulation

Interactive and sensory-distorted living space simulator

The Dementia Learning Centre in Denmark employs an innovative approach that uses simulation to educate healthcare professionals, relatives, and individuals with dementia about the disease.

Individuals firsthand experience what it is like to live with dementia through an interactive and sensory-distorted living space simulator. However, nothing in the living space appears as it should; things change positions or do not function as expected.

This makes it challenging to maintain an overview and perform even simple everyday tasks. This simulation provides a realistic experience of life with dementia. Following the simulation, there is a debriefing session where participants articulate their experiences and translate them into actions, with the aim of enhancing the care provided to individuals with dementia

Future perspectives

The Danish Government has initiated a structural commission to explore and present models for the development of the Danish healthcare system.

Key areas of investigation include maintaining consistency in healthcare delivery both the prevalence of extended and intersectoral care, distribution of tasks, ensuring uniformity, upholding patient rights, and assessing the involvement of private sectors. The Danish healthcare system faces several challenges such as clinical staff shortages,

data management, and the need for professional specialisation. To be comprehensive, the commission recognises the significance of looking at a new structure and organisation for the healthcare sector bearing in mind high digital ambitions.

Globally, the ageing population trend means a surge in demand for healthcare solutions. This necessitates the adoption of automation technologies and continuous investment in innovative health solutions.

The goal is not just to extend life but to improve quality of life. The advent of new technology promises revolutionary changes in conventional healthcare, introducing advanced medicines and treatments.

Denmark's tradition of collaborative endeavours between public institutions and private companies, paired with its proficiency in health data management, provides a solid foundation for leveraging artificial intelligence in healthcare.

Studies have shown great potential of automation in routine tasks, which can streamline healthcare processes.

Current projects in the Danish healthcare sector focus on maximising their potential by expanding across various regional segments. The structural commission also deliberates on organising diagnostic sectors such as imaging and lab tests at a national level for greater coherence and uniformity. Central to the digital transformation of healthcare is the emphasis on citizen-centric services.

References & Credits

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