

Decarbonising Danish Care Pathways for Greener Healthcare and better Outcomes

Adapting Global Insights to Local Action

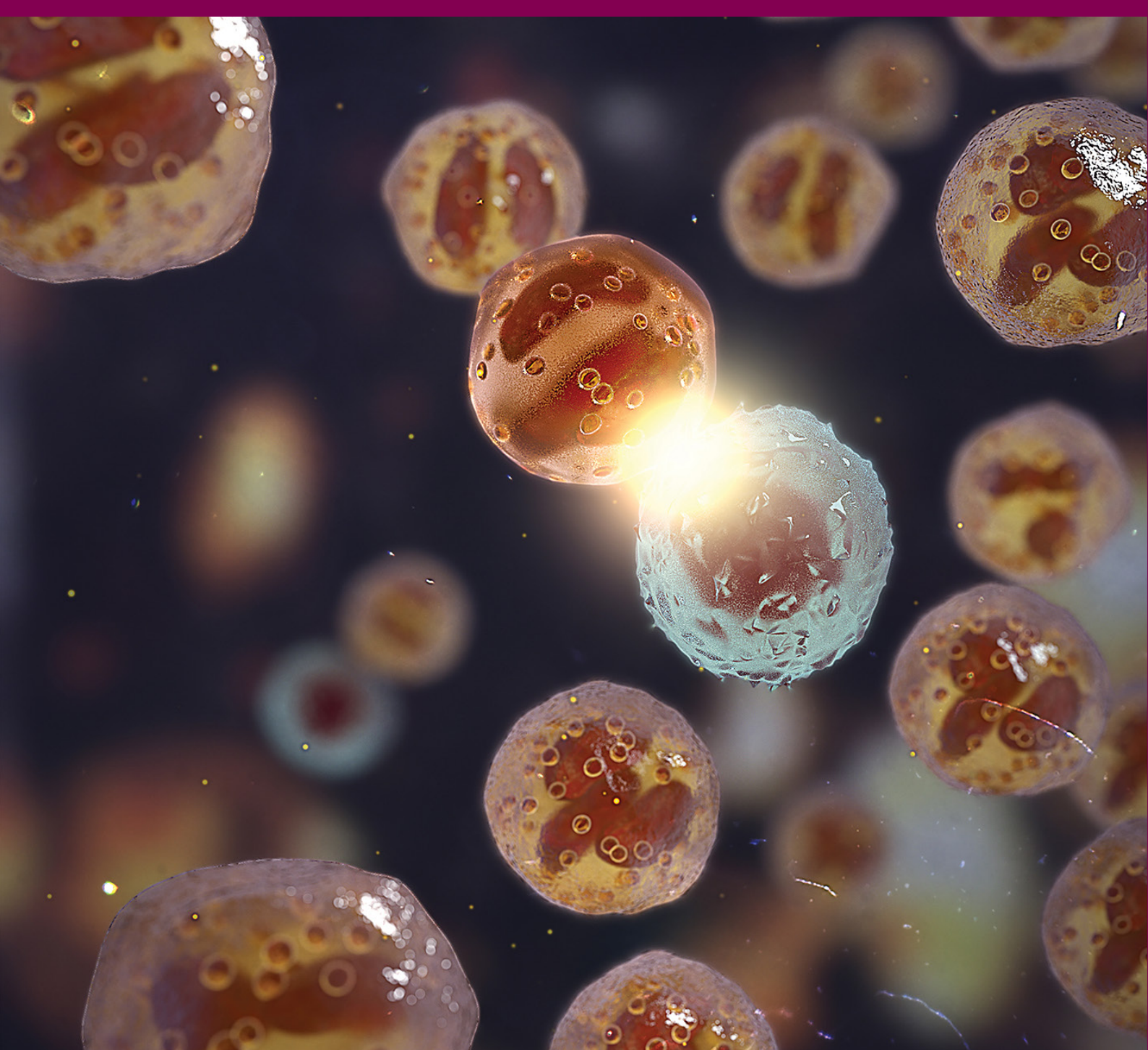


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Executive summary

Key Insights and Actions for Decarbonising Danish Healthcare

Healthcare contributes 6% of Denmark’s CO₂ emissions. With hospitals as major emitters, the Danish Regional Strategy for Green Hospitals targets a 50% emissions cut by 2035 (vs. 2022 levels) (Danske Regioner, 2023, pg. 6). However, reaching this goal requires more than renewable electricity, energy-efficient buildings, or green procurement. Earlier intervention and disease control to prevent disease progression and hospitalisations are some of the most powerful ways to improve outcomes for patients and reduce overall healthcare resource utilisation (HCRU), and thus also the carbon footprint of care.

This white paper sets out a strategic framework for decarbonising care pathways without reducing care quality. Drawing on global models, it identifies seven levers of change - from prevention and early diagnosis to remote care and sustainable treatment choices. It also outlines how healthcare delivery models must adapt to support this shift.

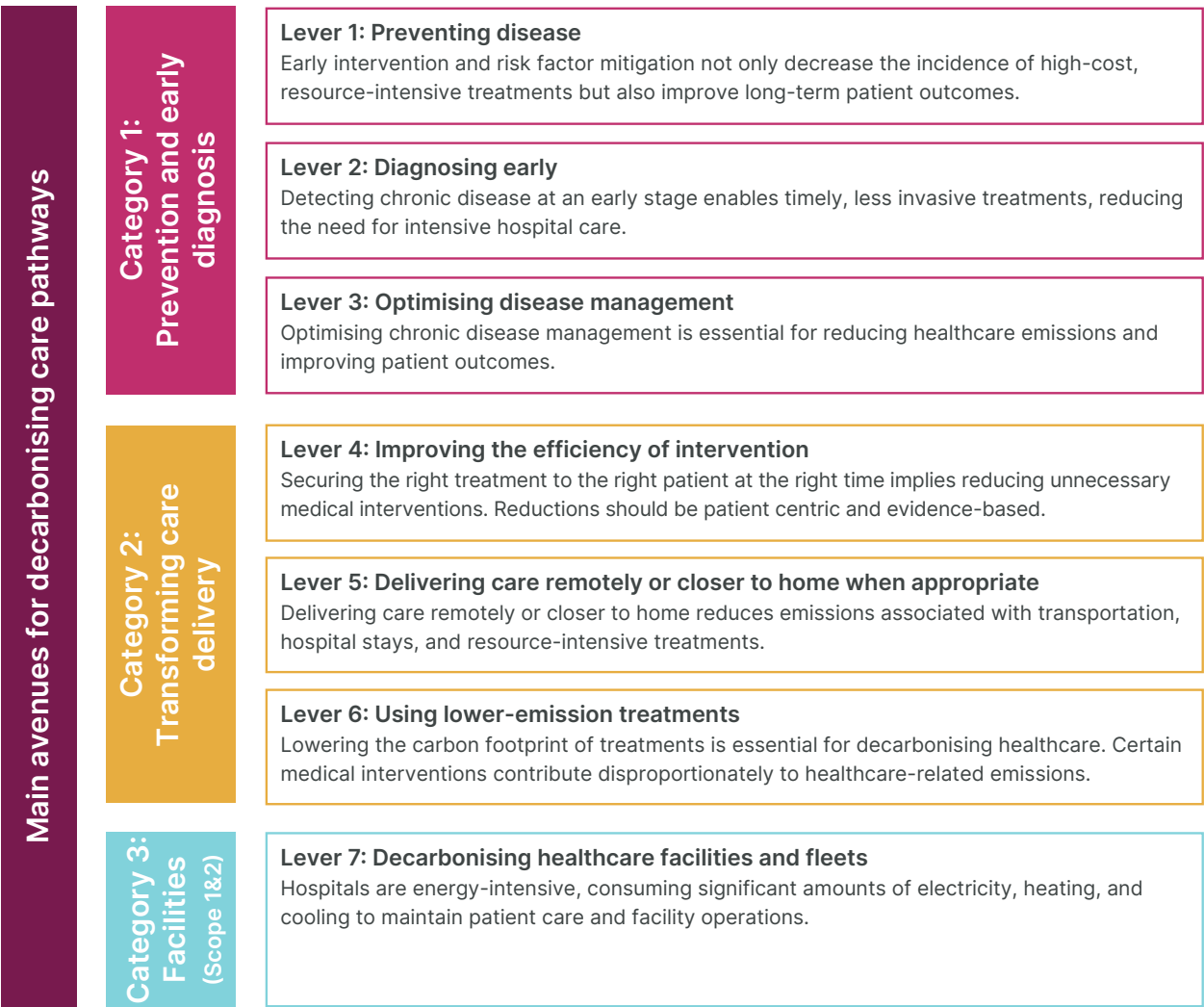
Two cases in this paper, chronic kidney disease (CKD) and type 2 diabetes (T2D), illustrate the impact:

- In-centre dialysis generates up to 3.2 tonnes CO₂e per patient annually. Earlier CKD detection could address this by enabling preventive treatment that slows down or stops disease progression.
- Diabetes care emissions reach 144 kg CO₂e/year per patient. Up to 34% can be addressed through primary prevention.

The report includes practical tools for mapping emissions across care pathways, adapting the Sustainable Healthcare Coalition’s methodology. It also provides a 5-step roadmap for Danish hospitals and regions, spanning evidence generation to scaling solutions.

The conclusion is clear: Decarbonisation of healthcare requires full system change - with coordinated efforts from policymakers, hospitals, clinicians, and industry. Care pathways are the starting point.

To decarbonise care pathways 7 levers are identified





Preface

Christof Bischoff, Country Director,
AstraZeneca Denmark

At AstraZeneca, we believe good health and a healthy planet go hand in hand. The climate crisis is not just an environmental issue - it's also a health issue. The way we design, deliver, and experience healthcare must reflect that.

This white paper is a step toward that understanding. It looks at how we can reduce the climate footprint of patient care - without compromising quality or access. In fact, many of the most climate-friendly choices are also those that lead to faster diagnoses, more efficient treatments, and better outcomes.

In Denmark, we are proud to be part of a healthcare system that values innovation and long-term thinking. But we also know that the transition to sustainable care is complex. It requires deep collaboration across sectors, disciplines, and organisations.

We do not have all the answers. But we do have knowledge, data, and a shared ambition: to create care pathways that serve both people and the planet. This work is about doing more with less - it's about doing things smarter. Starting earlier. Supporting patients better. And removing waste, not value.

Thank you to the partners, clinicians, researchers, and policymakers who have contributed to this paper. Together, we can make Danish healthcare a leading example of sustainability in action.

Let's move forward - with patients at the centre, and sustainability as our shared responsibility.

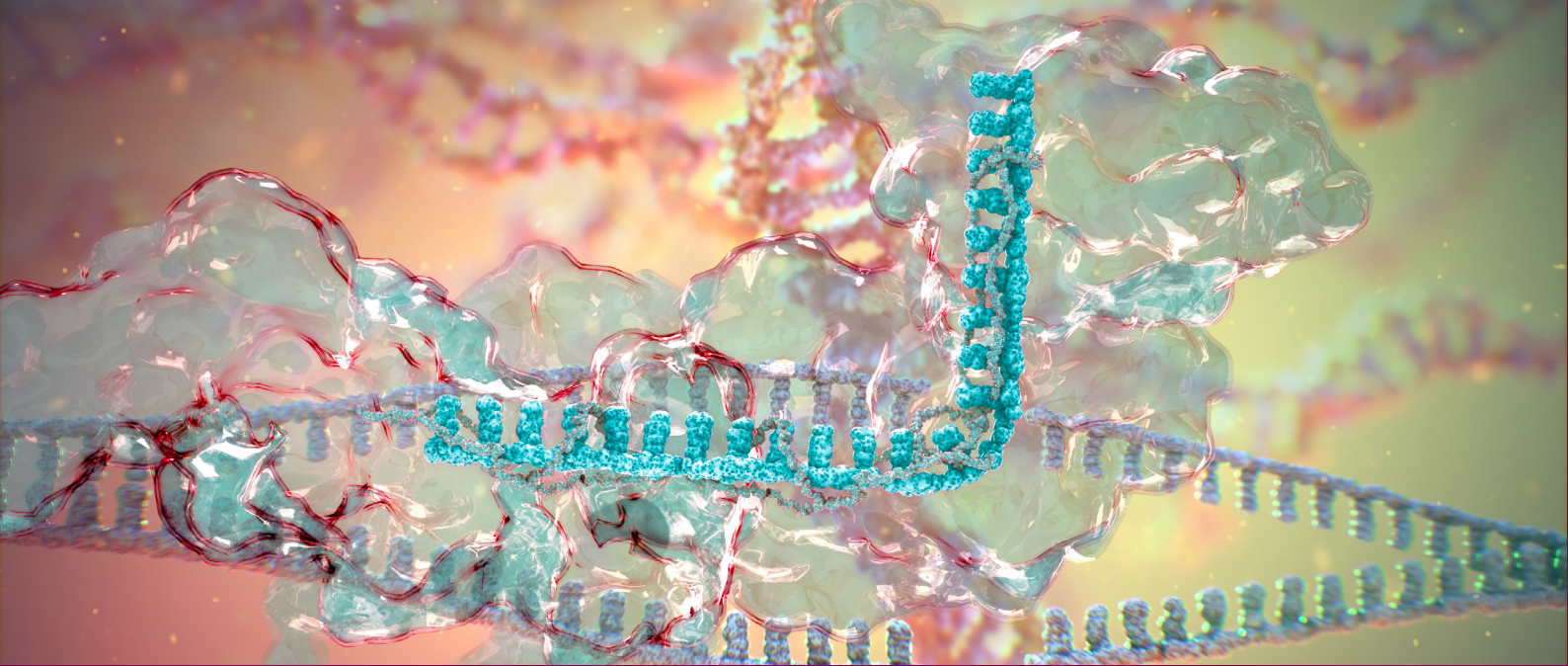


Preface

Camilla Hove Lund, Chairwoman of Danish
Regions' Committee for Environment and Climate

Danish Regions launched a strategy for sustainable hospitals in 2024, which sets an ambitious goal to reduce hospitals' CO₂ emissions by 50 percent in 2035 compared to 2022. The regions have already developed several initiatives and established a model for implementation as well as a model for monitoring emissions. But to reach the common goal, it is also necessary to take a holistic perspective on how we deliver healthcare.

In this regard, Danish Regions see care pathways as an interesting approach to reduce CO₂ emissions as it takes prevention, early diagnostics, and optimised efficiency of care delivery into account while maintaining or improving patient outcomes. Decarbonising care pathways involves collaboration between stakeholders, both public and private. Danish Regions therefore welcomes dialogue as well as evidence and inspiration about how to work with care pathways.



Shared Regional Goal

The regions will reduce CO₂ emissions from hospitals with 50% by 2035 against a 2022 baseline.

Chapter 1

Introduction

Healthcare plays a central role in our lives - safeguarding our wellbeing, extending life expectancy, and supporting the quality of life in our communities. Yet, behind this essential service lies a growing and often overlooked contributor to the climate crisis. As health systems around the world strive to care for people, they also face a new imperative: to care for the planet. Understanding the environmental impact of healthcare is the first step toward transforming it into a more sustainable system.

The healthcare sector is responsible for approximately 6% of global carbon emissions (Danske Regioner, 2023, pg. 6). Decisions related to facility design, service delivery, and treatment choices have a direct impact on healthcare emissions. Therefore, decarbonising healthcare is impossible without addressing care pathways.

The Danish Regional Strategy for Green Hospitals sets an ambitious goal: **a 50% reduction in hospital emissions by 2035¹**. It follows that all stakeholders must work together to drive action along the entire pathway of care to improve patient outcomes and reduce environmental impact.

This white paper provides a roadmap to achieving that goal, adapting global best practices to the unique Danish healthcare landscape.

¹ The Capital Region has set an even more ambitious goal to reach 50% reduction by 2030. Read the strategy from: Region Hovedestaden, 2024.

Purpose

Healthcare facilities, medicines, and medical devices in Denmark contribute significantly to carbon emissions (Danske Regioner, 2023, pg. 6). Decarbonising healthcare systems is crucial to reduce the negative environmental impact.

The Danish Regional Strategy for Green Hospitals' ambitious goals are setting the stage and direction for the transformation of the Danish healthcare sector. It is important to understand, that we cannot decarbonise the Danish society without including the healthcare industry, and we cannot fully decarbonise healthcare without working with care pathways.

Addressing sustainability in healthcare is still a young field. Research and investments have been focusing on replacing high-emission products with lower-emission ones; however these efforts can fall short as it does not address the full impact of patient treatments or suboptimising. A more holistic approach is gaining traction in Danish hospitals: **The Green Staircase**, a framework that prioritises sustainability in decision-making, guiding hospitals toward lower-emission solutions (Region Hovedstaden, 2025, pg. 5)

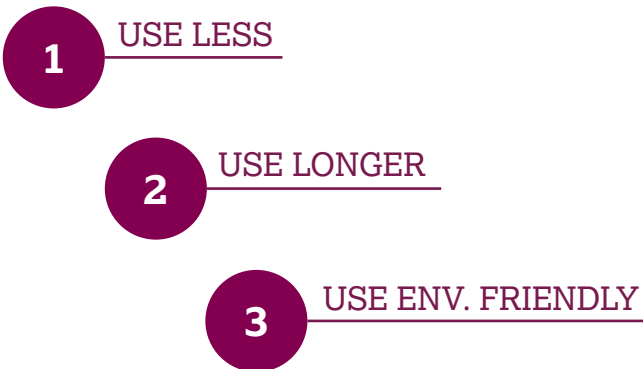


Figure: The Green Staircase

While switching to lower-emission products and services offers tangible benefits, this approach alone only addresses part of the problem. A growing body of evidence suggests that even greater impact can be achieved by rethinking how care is delivered. By examining the entire patient journey - from prevention and diagnosis to treatment and follow-up - with a shared focus on improving patient outcomes and reducing environmental impact, we can reveal opportunities to cut emissions, avoid unnecessary interventions, and enhance overall health benefits, thus lowering both economic and environmental costs.

Acknowledging, that by looking beyond a single product and at the full care pathway increases complexity, because it involves more stakeholders with different incentives, thus more data points to be included. This is not a quick fix, and the entire healthcare must be incentivised to change.

Denmark has a strong commitment to sustainability and innovation, and lead in the forefront of global efforts to reduce environmental footprint in healthcare.

Localised strategies must be developed to fully achieve the goals, and to ensure that healthcare systems remain both patient-centric and environmentally sustainable.

The care pathway approach is key to unlocking the complexities of healthcare delivery and recognising the interconnectedness of resources, services, and patient outcomes.

This white paper provides a practical roadmap for decarbonising care pathways in Denmark. By adapting global best practices to local needs this paper offers guidance for reducing emissions across healthcare. The paper is produced for healthcare professionals, policymakers, and sustainability leaders, as it supports efforts to achieve the goal of reducing hospital emissions with 50% by 2035 in the Danish Regional Strategy for Green Hospitals.

Scope

This white paper provides a clear path forward for reducing emissions in Danish healthcare. By aligning with global best practices and leveraging local strengths healthcare professionals, policymakers, and sustainability leaders can take concrete steps toward achieving the Danish Regional Strategy for Green Hospitals’ ambitious 50% emissions reduction target by 2035.

The paper explores the opportunities and challenges of decarbonising care pathways in Denmark, focusing on the following key areas:

Mapping emissions in Danish healthcare

Identifying where carbon emissions are concentrated and how they relate to the seven decarbonisation levers.

Applying global best practices

Adapting international frameworks and case studies to identify, how the seven key levers of change can be applied to the Danish context to reduce emissions without compromising patient care quality.

Practical case studies

Learning from the practical application of the levers through case studies of care pathways for chronic kidney disease and diabetes; two highly prevalent and resource-intensive diseases in Denmark.

Developing actionable tools and frameworks

Providing a toolbox for Danish hospitals, regions and affiliates that includes practical methods for benchmarking and measuring sustainability performance, as well as frameworks for knowledge sharing across regions and municipalities.

Fostering cross-sector collaboration

Engaging collaboration between healthcare providers, regulatory bodies, policymakers, and the private sector to accelerate decarbonisation efforts and improve long-term health system sustainability.

Key Concepts

This section introduces key concepts essential for understanding sustainability in care pathways. These concepts provide a foundation for reducing emissions in healthcare while maintaining high-quality patient care.

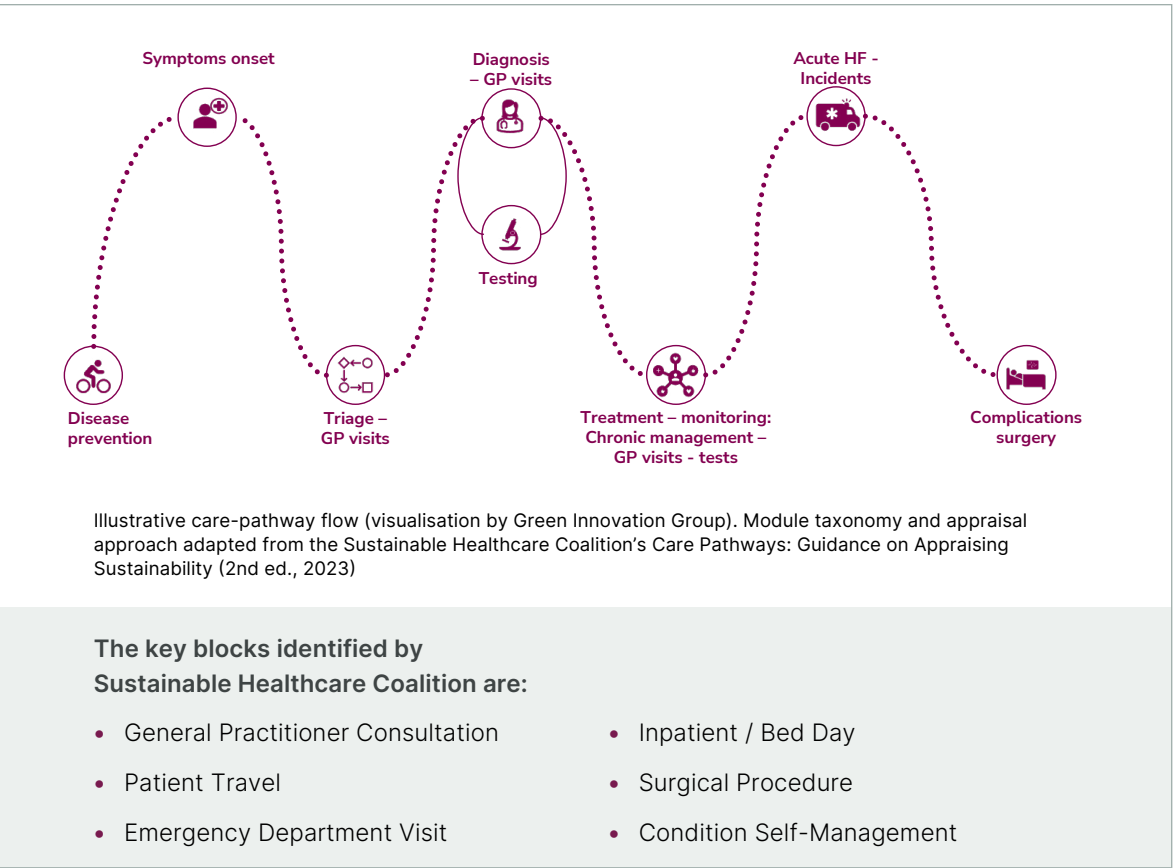
Care Pathway

A care pathway is a structured approach to patient care, covering the entire disease journey - from prevention and diagnosis to treatment, follow-up, and long-term management. It ensures that healthcare professionals deliver coordinated, evidence-based care with both patient outcomes and sustainability in mind.

This document aligns with the guidance of the Sustainable Healthcare Coalition (2023), and adopts the care pathway definition used by the European Pathway Association: “A care pathway is a complex intervention for the mutual decision-making and organisation of care processes for a well-defined group of patients during a well-defined period” (Schrijvers et al., 2012).

Care pathways can be separated into smaller modules, allowing them to be investigated individually or added together like building blocks to create an overall pathway, and analysis of where improvements can be made - whether in patient travel, surgical procedures, or self-management strategies.

A care pathway module is described as follows: “A care pathway module describes one or more distinct healthcare-related activities performed for, on behalf of, or by a patient. Care pathway modules are the building blocks which make up the total care pathway” (Sustainable Healthcare Coalition, 2023, pg. 20).



Sustainability

Sustainability in healthcare means delivering high-quality patient care while minimising environmental impact and ensuring long-term system resilience. Measuring and managing emissions in healthcare require structured frameworks, that help hospitals, policymakers, and suppliers take targeted actions towards a more sustainable healthcare system.

The Brundtland Commission defines sustainability as: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (World Commission on Environment and Development, 1987).

This principle forms the foundation for global sustainability efforts, focusing on balancing economic growth, social equity, and environmental protection to support long-term human and planetary health.

The strong interconnection between healthy people and a healthy planet cannot be reinforced enough. Earlier intervention and disease control to prevent exacerbations and hospitalisations are some of the most powerful ways to improve outcomes for patients and reduce overall HCRU, and thus also the carbon footprint of care.

In the context of healthcare, sustainability balances three key dimensions:

1. **Environmental:** Reducing greenhouse gas (GHG) emissions, medical waste, and water consumption.
2. **Social:** Ensuring equitable access to sustainable healthcare solutions.
3. **Financial:** Managing healthcare resources efficiently to maintain economic viability.

Among all sustainability challenges, climate change poses the most immediate risk to healthcare systems. Healthcare accounts for 5% of global emissions, with care pathways responsible for over 40% of that total. The Stockholm Resilience Centre highlights planetary boundaries, identifying climate change, biodiversity loss, and freshwater depletion as critical limits we must not exceed.

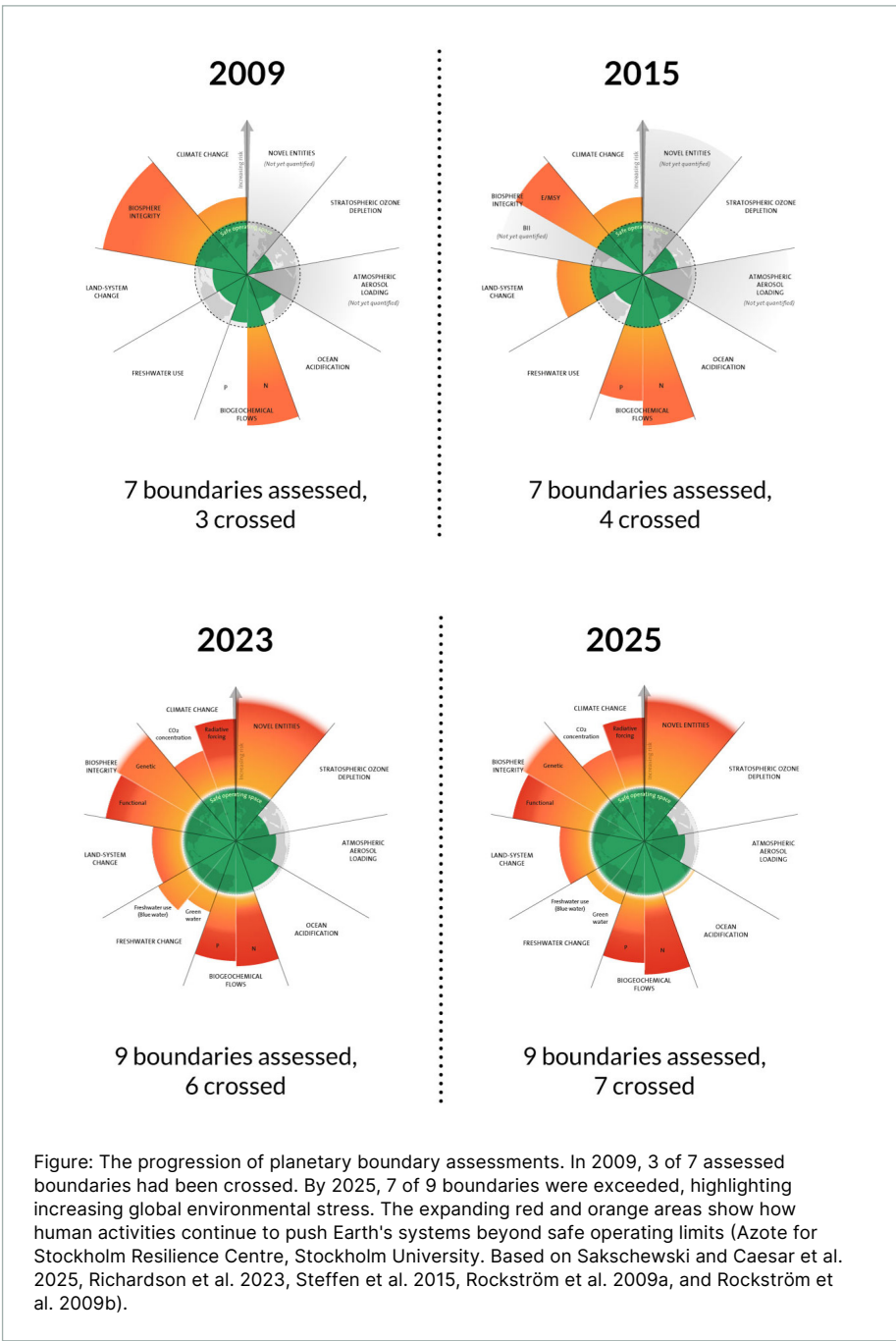
Transforming Care within a Single-Planet Budget

In healthcare, the goal of providing the most effective care while staying within “single-planet” resource limits emphasises balancing care quality with sustainable resource use and resilience in the healthcare sector. This concept encourages designing healthcare pathways that minimise environmental impact and utilise resources efficiently to align with broader planetary sustainability goals.

This white paper primarily focuses on reducing CO₂ emissions in Danish healthcare, while also considering broader sustainability indicators such as waste reduction and waste management.

Planetary Boundaries

The Stockholm Resilience Centre – one of the leading sustainability research centers - has identified nine planetary boundaries, including climate change, biodiversity loss, and ocean acidification, that mark the ecological limits within which humanity can operate safely. Crossing these boundaries risks destabilising Earth’s systems, making this framework crucial for understanding the environmental thresholds that sustainable practices should respect. These boundaries were recently reassessed by a team of scientists led by a team of scientists, their framework update finds that seven of the nine boundaries are transgressed, suggesting that Earth is now well outside of the safe operating space for humanity. The seven boundaries being Climate Change, Biosphere integrity, Land System Change, Freshwater Change, Biogeochemical Flows, Novel entities, and Ocean acidification.



The GHG Protocol and the Paris Agreement

The Greenhouse Gas (GHG) Protocol offers a global framework for measuring and managing greenhouse gas emissions. This is needed to align with the Paris Agreement’s goal to limit global warming below 2°C. It helps organisations evaluate emissions across Scope 1, 2, and 3 and adopt climate mitigation measures.

- **Scope 1** emissions are direct emissions from owned or controlled sources like cars and company buildings.
- **Scope 2** emissions are indirect emissions from the generation of purchased energy.
- **Scope 3** emissions are all indirect emissions (not included in scope 2) that occur in the value chain of the reporting organisation, including both upstream and downstream emissions. The protocol has been created through a 20-year collaboration between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), the GHG Protocol works with governments, businesses, and NGOs to standardise GHG measurement and reporting across sectors and supply chains.

ISO Standards for Life Cycle Assessment (LCA) and Carbon Accounting

ISO standards, particularly ISO 14040 and 14067, guide Life Cycle Assessment (LCA) and carbon footprint measurement for products and organisations. LCA evaluates the environmental impact of products throughout their life cycle, while ISO 14067 specifies requirements for measuring and reporting carbon footprints, enabling transparency and improvement in sustainability practices.

Regulatory Frameworks: CSRD and CSDDD

The Corporate Sustainability Reporting Directive (CSRD) and Corporate Sustainability Due Diligence Directive (CSDDD) in the EU require companies to report on environmental, social, and governance (ESG) metrics, promoting corporate accountability and sustainability. These frameworks ensure that businesses incorporate sustainability into their operational strategies and disclose their impact. The frameworks are currently being updated which could alter what is being reported on and which companies are required to report.

Solution-Oriented Frameworks and Initiatives

- **Science-Based Targets initiative (SBTi):** SBTi supports companies in setting greenhouse gas reduction targets in line with climate science, focusing on ambitious but achievable goals to mitigate climate change.
- **Carbon Disclosure Project (CDP):** CDP encourages organisations to disclose their environmental impact, offering insights to drive transparency and accountability.
- **B Corp Certification:** B Corp certifies companies based on their social and environmental performance, fostering business responsibility for sustainable development.



Healthcare-Specific Sustainability Initiatives

Sustainability in healthcare is a global challenge, and several initiatives are leading the way in reducing emissions, promoting circular economies, and integrating sustainability into healthcare operations. These organisations work across policy, industry collaboration, and accountability frameworks to support healthcare institutions in their transition to a low-carbon future.

- **Sustainable Markets Initiative (SMI)** promotes a shift to sustainable markets by encouraging the adoption of environmentally friendly practices. It has task forces across industries including one for healthcare. SMI emphasises creating solutions that benefit both people and the planet.
- **Sustainable Healthcare Coalition (SHC)** brings together healthcare stakeholders to develop sustainable care models that reduce environmental impact. Its work includes creating efficient, environmentally friendly patient pathways and focusing on resource efficiency in care delivery. SHC offers models for sustainable patient management and encourages collaboration across organisations to achieve environmental targets without compromising patient care.
- **Healthcare Without Harm (HCWH)** works globally to transform healthcare systems to be ecologically sustainable and resilient. HCWH focuses on reducing the sector’s carbon footprint, managing waste responsibly, and avoiding harmful chemicals. Organisations can leverage HCWH’s guidelines to minimise environmental impacts across hospitals and clinical practices, benefiting both public health and the planet.



Chapter 2

The Climate Footprint of Danish Healthcare

Climate change is one of the greatest threats to public health—and healthcare itself is part of the problem. In Denmark, the healthcare sector is responsible for 6% of the country’s total consumption-based CO₂ emissions, nearly double the share it had in 1990 (3,5%) (Danske Regioner, 2023). Hospitals, which consume vast amounts of energy, medical equipment, and transport services, are among the biggest contributors.

While healthcare is dedicated to saving lives and improving well-being, it also faces rising challenges due to climate change—from heatwaves increasing patient admissions to extreme weather events disrupting supply chains. To succeed in Denmark’s green transition, healthcare must take a leading role in cutting emissions and building climate-resilient health systems.

The Danish Regional Strategy for Green Hospitals

Across Europe, healthcare systems are stepping up climate action, with countries like the UK, Sweden, and Norway already implementing comprehensive decarbonisation plans.

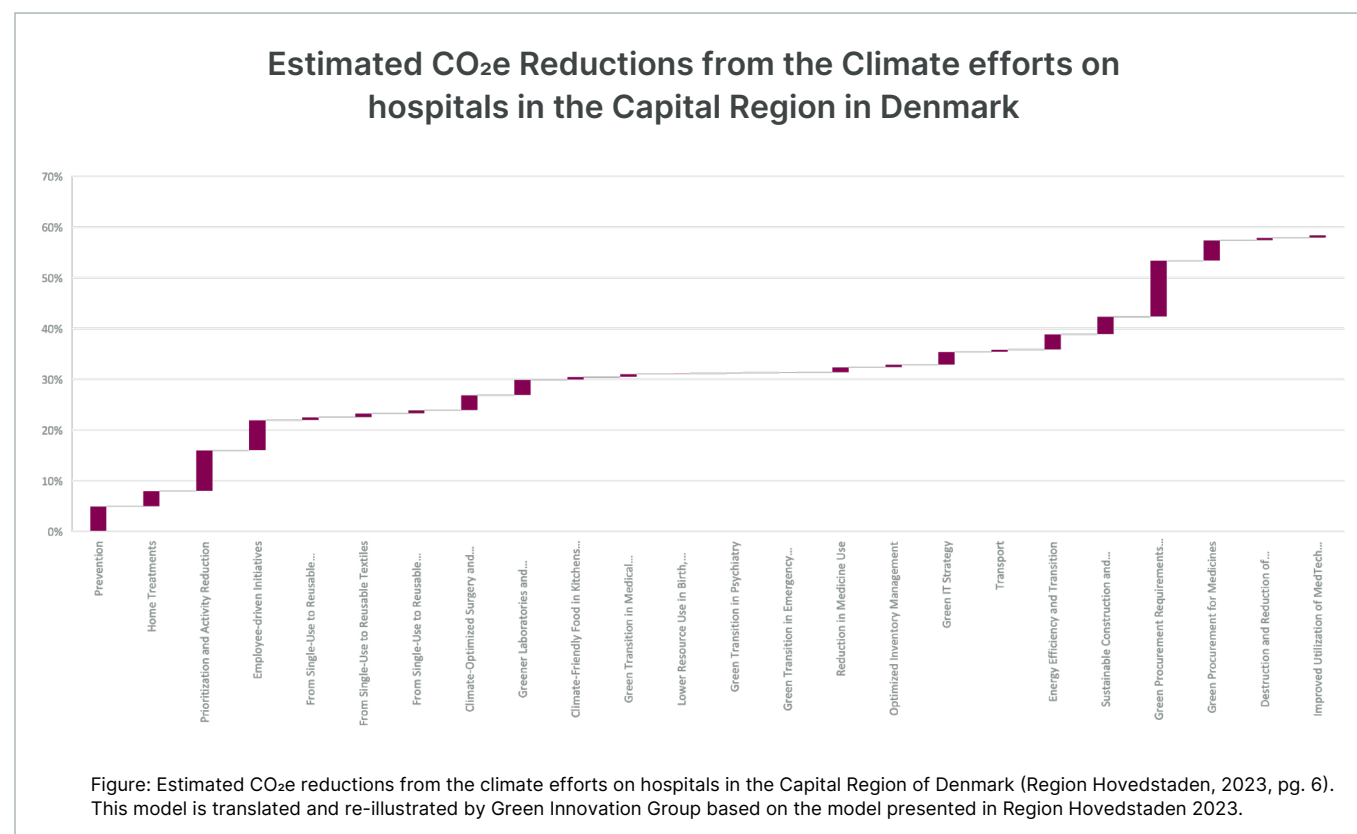
The Danish Regional Strategy for Green Hospitals aims to transition to a more sustainable healthcare system without compromising treatment quality or safety. The strategy aims to reduce hospital emissions by 50% by 2035. To achieve this, the strategy focuses on three key areas:

- 1. **Procurement:** Drive market changes by setting green requirements for suppliers of medical equipment, textiles, and pharmaceuticals. Reduce climate impacts throughout the supply chain.
- 2. **Circular Economy and Behaviour:** A shift from disposable to reusable medical tools, cutting food and medicine waste, and optimising recycling systems.
- 3. **Energy Consumption, Transport, and Buildings:** Phase out oil and gas heating, adopt energy-efficient solutions, and invest in renewable energy like solar and wind power. Reduce CO₂ emissions from transport by converting to electric vehicles and improving logistics.

Strategy measurement

The strategy includes the following 5 supporting measures:

- 1 Develop climate competencies and involve employees.
- 2 Introduce a common climate management model.
- 3 Focus on development and innovation in key areas.
- 4 Establish a model for disseminating effective climate solutions.
- 5 Form partnerships with authorities and companies to foster greener practices.



The Need for Collaboration

Tackling climate change in Danish healthcare requires a united effort, from hospitals and municipalities to suppliers, policymakers, and international partners, by sharing best practices, coordinating climate policies, and investing in sustainable solutions.

10 Regional Lead Areas for green Development and Innovation have been distributed across the regions and Amgros, identifying existing solutions and driving development and testing for future deployment across all regions. Lead regions also facilitate knowledge sharing and engage stakeholders, including industry, patient associations, and research groups.

Through the establishment of shared climate governance models, Danish healthcare institutions are working together to prioritise and implement the most effective carbon-reduction measures. The Capital Region has identified 24 climate efforts to address the reduction target across different areas as shown in this figure (Region Hovedstaden, 2023).

This cooperative approach ensures that best practices and innovations can be scaled rapidly across the healthcare system, driving the entire sector toward a climate-neutral future by 2050.

In summary, the Danish Regional Strategy for Green Hospitals (Danske Regioner, 2023, pg. 6) is not just

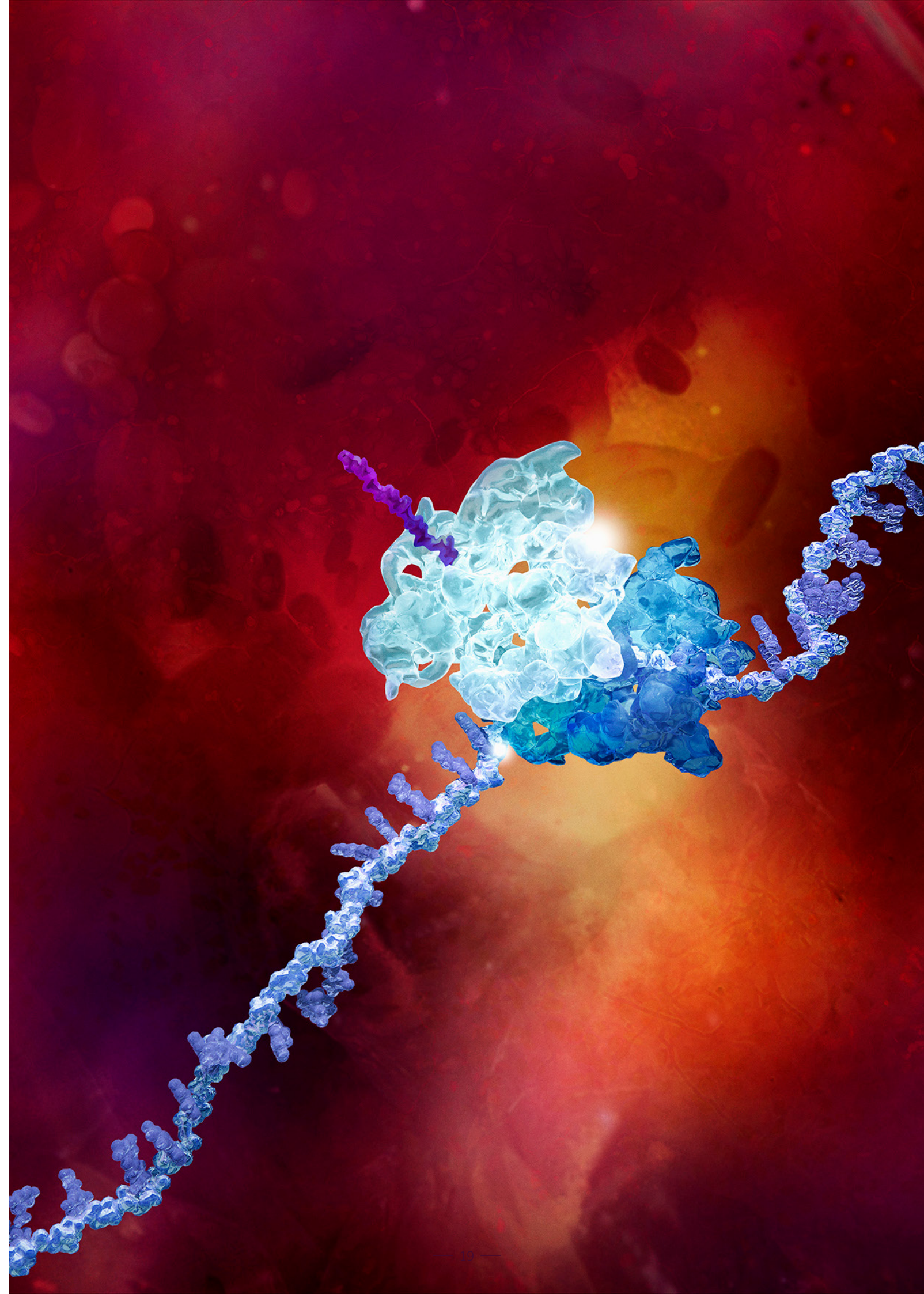
a response to these challenges but a proactive step toward a more sustainable and resilient healthcare system. Denmark has a unique opportunity to lead the world in climate-smart healthcare.

By cutting emissions, investing in clean energy, and rethinking care pathways, Danish hospitals can protect both patients and the planet, proving that a greener healthcare system is not just possible, but essential. However, a whole-system approach is crucial to fully achieve carbon neutrality across the sector.

This strategy should serve as a catalyst for driving advancements in:

- Targeted actions for sustainable product manufacturing.
- Targeted improvements in product distribution and logistics.
- Innovation in clinical research and development.
- Enhancing the delivery of patient care.

This white paper advocates for a care pathway approach as the key to decarbonising the Danish healthcare system. By focusing on this holistic approach, we aim to not only reduce the carbon footprint of healthcare but also improve patient outcomes and optimise the cost-effectiveness of care delivery.





Chapter 3

The Levers of Change to Reduce Emissions Along the Care Pathway

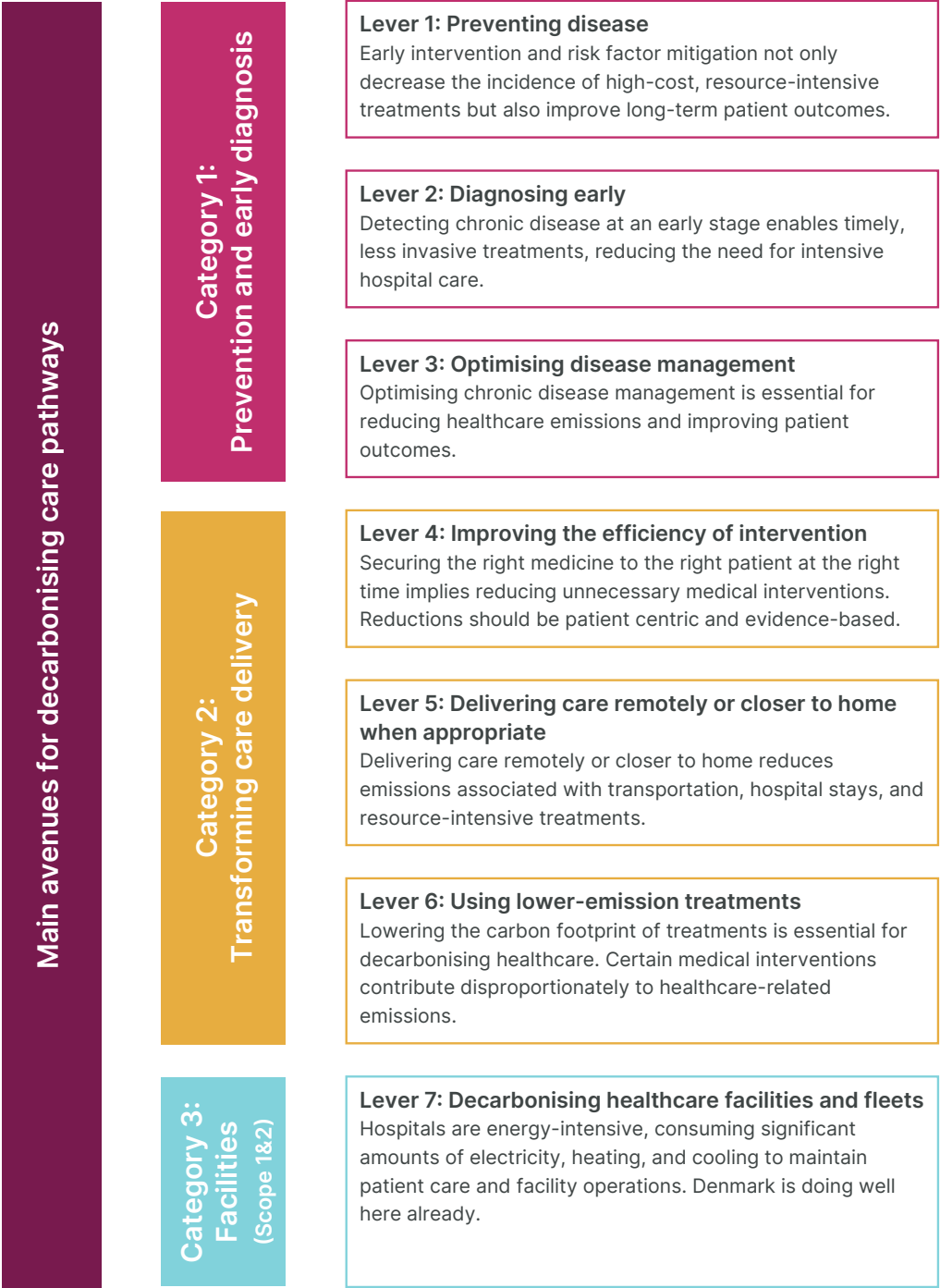
Reducing emissions in healthcare requires a holistic approach that integrates sustainability across all stages of patient care. This white paper draws on the SMI framework, which identifies seven key levers for decarbonising care pathways while maintaining high standards of patient care.

The seven levers of change fall into three primary categories:

- 1. **Prevention and early diagnosis:** Improving prevention and care primarily by preventing disease onset, early diagnosis and improved disease management to reduce disease frequency and severity, lowering the demand for intensive treatments.
- 2. **Transforming care delivery:** Delivering care differently by optimising the efficiency of care delivery and choosing interventions that offer lower carbon footprints while maintaining or improving healthcare outcomes.
- 3. **Facilities:** Decarbonising healthcare facilities and fleets through technological innovations (such as renewable energy and electric vehicles) and promoting circularity by using reusable and recyclable materials.

The following sections will explore these seven levers in depth, examining their potential to transform care pathways in the Danish healthcare system within the framework outlined by SMI.

The 7 levers of change



Lever 1: Preventing disease	Lever 2: Diagnosing early	Lever 3: Optimising disease management	Lever 4: Improving the efficiency of intervention
Lever 5: Delivering care remotely or closer to home when appropriate	Lever 6: Using lower-emission treatments	Lever 7: Decarbonising Healthcare Facilities and fleets	

Lever 1

Preventing Disease Onset

Preventing chronic diseases is one of the most effective strategies for reducing healthcare-related emissions. Early intervention and risk factor mitigation not only decrease the incidence of high-cost, resource-intensive treatments but also improve long-term patient outcomes.

By prioritising preventive care, healthcare systems can lower hospital admissions, reduce reliance on carbon-intensive treatments, which leads to better health outcomes and lower environmental impacts. However, many of the most well-documented vehicles for prevention are outside the mandate and scope of the healthcare system, i.e., smoking cessation, regular exercise, healthy diet and sleeping habits.

Prevention Programs in Denmark

Denmark is a leader in disease prevention, implementing a robust childhood vaccination program that has significantly reduced the prevalence of vaccine-preventable diseases such as measles and polio. All vaccines paid by the Danish healthcare insurance system have been registered since 1996. The Danish Vaccination Registry (introduced in 2013) plays a crucial role in tracking vaccinations and ensuring high coverage rates across the population (Statens Serum Institut, 2024). This data-driven approach has been instrumental in maintaining high vaccination uptake and preventing outbreaks (Finnegan, 2023).

Vaccination efforts have proven to be a key component in Denmark's healthcare prevention strategies, not only improving public health outcomes but also reducing the need for resource-heavy treatments at a later stage. This aligns with broader efforts to decarbonise healthcare through effective disease prevention.

Lever 1: Preventing disease	Lever 2: Diagnosing early	Lever 3: Optimising disease management	Lever 4: Improving the efficiency of intervention
Lever 5: Delivering care remotely or closer to home when appropriate	Lever 6: Using lower-emission treatments	Lever 7: Decarbonising Healthcare Facilities and fleets	

Lever 2

Diagnosing Early

Early diagnosis significantly improves patient outcomes and reduces the environmental impact of late-stage disease management. Detecting conditions such as cancer, cardiovascular diseases, and diabetes at an early stage enables timely, less invasive treatments, reducing the need for intensive hospital care.

A pilot study in Malaysia demonstrated that low-cost early cancer surveillance programs reduced late-stage breast cancer diagnoses by nearly 50% over four years (Devi et al., 2007), highlighting the potential impact of early intervention strategies. Applying similar targeted screening initiatives in Denmark could yield comparable benefits in both health outcomes and carbon footprint reduction.

More than one in three Danes live with one or more chronic diseases that to a greater or lesser extent give them limitations, reduced quality of life and, in the worst case, shorter lives (Sundhedsstyrelsen, 2022, p. 13). With early detection of the disease, the right treatment, education in mastering one's illness and ongoing follow-up, more people with chronic illness can live good lives, and fewer will need hospitalisation reducing the carbon footprint of the disease (Danske Regioner, 2024).

The **Step-wise Approach to Chronic Disease Prevention** that has been deployed in Denmark uses personal digital health profiles and targeted follow-ups to monitor and manage risks for conditions like diabetes and cardiovascular disease for high-risk groups. This initiative, which incorporates general health checks and lifestyle interventions, has demonstrated a notable reduction in the progression of chronic diseases, thereby minimising the demand for energy-intensive treatments (Larsen, 2019).

An example of this is the breast cancer screening program: Every second year, all women in Denmark between the ages of 50 and 69 are offered a mammogram - an X-ray examination of the breast. The results from 2021 shows that the screening program finds 2/3 of breast cancer cases in this age group, and that 84 percent of the invited women accept the offer (Dansk Kvalitetsdatabase for Mammografiscreening, 2021).

Preventative care such as early screenings, vaccinations, and healthier lifestyles, can reduce the demand for complex and resource-intensive treatments for chronic conditions like diabetes, cardiovascular diseases or CKD. This proactive approach, led by healthcare professionals, allows for early interventions that help prevent chronic conditions like diabetes or cardiovascular diseases from progressing to more severe stages that require intensive care which improves patient outcomes but also reduces the environmental impact of managing these long-term conditions.

Early diagnosis can lead to overdiagnosis - the detection of conditions that would not cause symptoms or harm in a patient's lifetime (Institute for Quality and Efficiency in Health Care (IQWiG), 2006). This can result in unnecessary treatment and anxiety. GPs are already under pressure, so broad screening across all areas isn't feasible and must be carefully prioritised.

Lever 1: Preventing disease	Lever 2: Diagnosing early	Lever 3: Optimising disease management	Lever 4: Improving the efficiency of intervention
Lever 5: Delivering care remotely or closer to home when appropriate		Lever 6: Using lower-emission treatments	Lever 7: Decarbonising Healthcare Facilities and fleets

Lever 3

Optimising Disease Management

Optimising chronic disease management is essential for reducing healthcare emissions and improving patient outcomes. Conditions such as CKD and diabetes account for a significant proportion of hospital admissions, pharmaceutical use, and medical waste production.

Once a condition is identified, early, guideline-based care can help slow progression and avoid complications. For chronic kidney disease, this means regular monitoring, managing risk factors (e.g., blood pressure and blood sugar), and timely, coordinated follow-up. Done well, this approach supports better stability for patients and can reduce avoidable hospital visits.

Optimising Clinical Pathways

Optimising care pathways for chronic conditions can streamline treatment and reduce unnecessary hospitalisations, further lowering emissions. Reducing reliance on certain rescue treatments and lowering exacerbation rates can improve patient outcomes and decrease environmental impact - with potential reductions of up to 128 kg CO₂e per patient per year. Denmark’s integrated care model already supports cross-specialist collaboration, but further efforts to enable community-level interventions, such as early diagnostics and telemedicine, can reduce hospital visits and enhance disease management. Likewise improving remote monitoring for heart failure or diabetes, Denmark can reduce emissions associated with frequent hospital stays while improving patient care.

Lever 1: Preventing disease	Lever 2: Diagnosing early	Lever 3: Optimising disease management	Lever 4: Improving the efficiency of intervention
Lever 5: Delivering care remotely or closer to home when appropriate		Lever 6: Using lower-emission treatments	Lever 7: Decarbonising Healthcare Facilities and fleets

Lever 4

Improving the Efficiency of Intervention

Securing the right medicine to the right patient at the right time implies reducing unnecessary medical interventions. Reductions should be patient centric and evidence-based.

The Vælg Klogt initiative, launched in Denmark in 2020 as part of the international Choosing Wisely movement led by the American Board of Internal Medicine Foundation aims to reduce unnecessary tests, treatments, and procedures by promoting evidence-based, patient-centred decision-making. In Denmark, overuse is recognised as an issue, with the initiative aiming to both reduce healthcare costs and environmental waste (Malling, 2021).

One area for efficiency improvement is reducing unnecessary follow-up appointments. According to Vælg Klogt, the Danish healthcare system can benefit from solutions like patient-initiated follow-ups, where patients take the lead in scheduling their own post-care appointments based on need. This is particularly relevant for patients with diabetes that are well-regulated. Removing redundant follow-up appointments reduces the administrative and clinical burden on hospitals and cuts emissions from unnecessary patient visits.

A recent literature review suggests that the number of blood samples in intensive care units can likely be reduced without posing health risks. Another review identifies clinical decision support systems as an effective solution to minimise unnecessary blood tests (Vælg Klogt, Blodprøver).

In the US, around 25% of antibiotic prescriptions in ambulatory care are inappropriate. Similar trends have been found in Denmark, especially with antibiotics prescribed for upper respiratory infections and for patients with bacteria in the bladder who show no symptoms of a bladder infection (Vælg Klogt, Antibiotika til luftvejsinfektion).

By focusing on efficiency, Denmark can ensure high-quality care while reducing the environmental impact of its healthcare system.

Lever 1: Preventing disease	Lever 2: Diagnosing early	Lever 3: Optimising disease management	Lever 4: Improving the efficiency of intervention
Lever 5: Delivering care remotely or closer to home when appropriate		Lever 6: Using lower-emission treatments	Lever 7: Decarbonising Healthcare Facilities and fleets

Lever 5

Delivering Care Remotely or Closer to Home when Appropriate

Expanding remote care options is a key strategy for reducing emissions in healthcare while maintaining high-quality patient outcomes. Delivering care remotely or closer to home reduces emissions associated with transportation, hospital stays, and resource-intensive treatments.

Telemedicine, digital consultations, and remote patient care have been shown to lower healthcare emissions by reducing the number of physical visits and hospital stays. During the COVID-19 pandemic, Denmark saw a significant increase in virtual healthcare appointments, demonstrating the feasibility of scaling remote care solutions without compromising quality.

Providing care at home, where appropriate, reduce emissions from patient transport, as well as reliance on hospital resources and the associated carbon emissions. For chronic conditions such as stage-5 CKD, where regular treatments like dialysis are needed several times per week, offering home-based dialysis can lead to reduced energy and resource use at centralised healthcare facilities¹. Moreover, it allows patients to receive the care they need in a more comfortable and less resource-intensive environment. However, the waste from at-home dialysis is a large burden to handle for the patient who will produce overwhelming amounts of potentially hasardous waste ranging from 1.5 kg to 8 kg of waste per session or towards 1.2 metric tonnes per year for patients with 3 weekly treatments (Piccoli, et al., 2015).

Even for care delivered within healthcare facilities, optimising the care pathway can make a significant impact. By reducing unnecessary hospital stays and streamlining patient flows, hospitals can lower their operational carbon footprint. Additionally, ensuring timely and efficient care can prevent extended hospitalisations, reducing costs and emissions.



”Many patients want to do dialysis at home, but bulky machines and excessive consumables discourage them. If smaller, home-friendly machines were available, it is plausible that many more would choose home dialysis.”

Michael Buksti
CEO, Danish Kidney Association

¹ At home dialysis treatment is offered to stage 5 CKD patients in Denmark, according to the kidney association the machinery is very large and cumbersome, smaller devices might enable more CKD patients to choose home treatment (Interview).

Lever 1: Preventing disease	Lever 2: Diagnosing early	Lever 3: Optimising disease management	Lever 4: Improving the efficiency of intervention
Lever 5: Delivering care remotely or closer to home when appropriate	Lever 6: Using lower-emission treatments		Lever 7: Decarbonising Healthcare Facilities and fleets

Lever 6

Using Lower-emission Treatments

Lowering the carbon footprint of treatments is essential for decarbonising healthcare. Certain medical interventions contribute disproportionately to healthcare-related emissions.

Treatments with high Global Warming Potentials (GWP) are still widely used in Denmark. A shift toward options with lower environmental footprints is underway and expected to significantly reduce emissions. However, as seen in other health systems, it’s crucial that this shift is done in consultation with patient needs and capabilities.

It may be even more relevant to explore which elements of asthma care have the greatest impact on patient outcomes and on preventing exacerbations. A UK-based quality improvement initiative tested ways to strengthen adherence to local guidelines by addressing over-reliance on short-term symptom relief and optimising long-term disease control. Early results showed changes in prescribing patterns and a shift in the overall mix of therapies. These developments contributed to a lower climate footprint and aligned with national healthcare sustainability ambitions.



“At Herlev and Gentofte Hospital and Rigshospitalet, we have managed to reduce the water consumption related to hemodialysis treatment by 7,5 million liters of water yearly. The reductions came from adjusting the water usage and settings of our backup and workshop water purification system. We have done this without compromising the quality of treatment for the patients. We believe that similar results could be achieved in other places. The biggest hurdle for making the change was awareness of the possibility to reduce our water consumption.”

Rizwan Butt
Chief Physician, Herlev Hospital

Lever 1: Preventing disease	Lever 2: Diagnosing early	Lever 3: Optimising disease management	Lever 4: Improving the efficiency of intervention
Lever 5: Delivering care remotely or closer to home when appropriate	Lever 6: Using lower-emission treatments	Lever 7: Decarbonising Healthcare Facilities and fleets	

Lever 7

Decarbonising Healthcare Facilities and Fleets

Decarbonising healthcare infrastructure is one of the most effective ways to achieve large-scale emissions reductions. Hospitals are among the most energy-intensive buildings, consuming significant amounts of electricity, heating, and cooling resources to maintain patient care and facility operations.

7.1 Renewable Energy Transition

Switching to renewable energy sources, such as wind, solar, and geothermal, can cut healthcare emissions by up to 70%. Danish hospitals are uniquely positioned to leverage Denmark’s strong renewable energy sector, this is also reflected in the Capital Region only attributing 5% of its emissions to energy and transport (Region Hovedstaden, 2023, pg. 3).

For example, a 70% reduction in CO₂ emissions from the hospitals’ energy consumption has already been achieved in the Capital Region (Region Hovedstaden, 2024). Much of the reduction is because the supply of the hospitals comes from more renewable energy sources, but the hospitals’ own energy efficiency projects are also contributing.

7.2 Energy Efficiency

In addition to transitioning to renewable energy, enhancing energy efficiency within healthcare facilities can deliver quick and significant emission reductions. This can include:

- Improving heating, ventilation, and air conditioning (HVAC) systems to reduce energy consumption.
- Energy management turning off energy consuming equipment in off-hours when possible and recalibration is not a concern.
- Optimising building insulation and design to reduce heat loss and minimise energy demand.
- The Danish Regional Strategy for Green Hospitals already highlights energy optimisation as a priority, aligning well with this lever’s goal.

Lever 1: Preventing disease	Lever 2: Diagnosing early	Lever 3: Optimising disease management	Lever 4: Improving the efficiency of intervention
Lever 5: Delivering care remotely or closer to home when appropriate	Lever 6: Using lower-emission treatments	Lever 7: Decarbonising Healthcare Facilities and fleets	

7.3 Water and Waste Management

Water and waste are additional areas where healthcare facilities can improve and reduce their footprint. Hospitals consume large amounts of water daily for patient care, cleaning, and cooling systems (Miljøstyrelsen, 2016)¹. Moreover, adopting circular economy principles and encouraging sustainable procurement can lower the environmental impact of waste produced in healthcare facilities. Hospitals can also reduce medical waste, which is often energy-intensive to dispose of, by opting for reusable medical supplies when safe and possible.

Reducing Waste Through Patient Pathway Optimisation

At the Surgical Ward in Viborg, analysing patient journeys and staff workflows led to a 38% reduction in daily waste and 35% less clinical risk waste, cutting costs while maintaining patient safety (Region Midtjylland, 2021).

Key actions included:

- Switching plastic cups to glass.
- Reducing garbage bags and rental paper.
- Sorting recyclable materials, e.g., pill boxes.

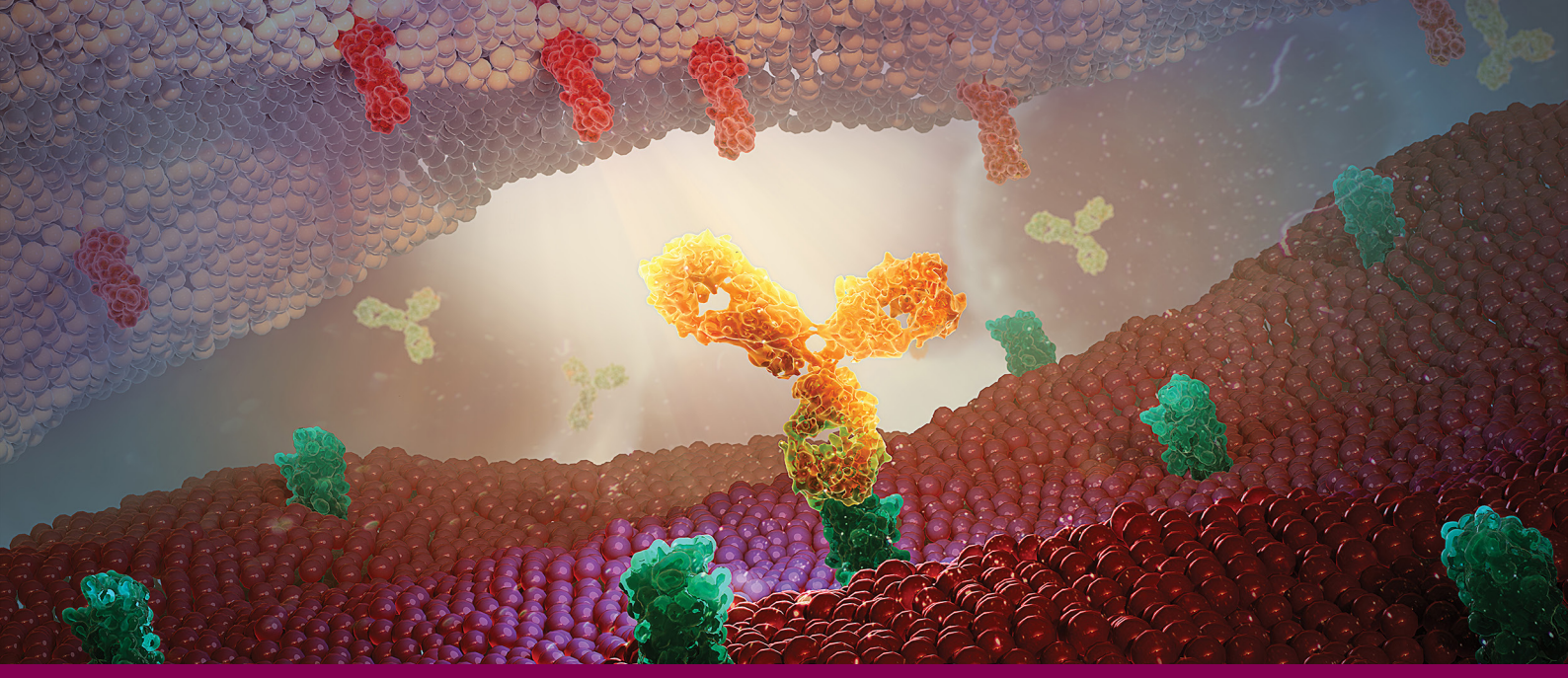
Some changes were simple, while others required clinical validation. For example, eliminating saline rinsing in antibiotic infusions could save 60 plastic bottles daily, but was deemed unsafe.

This resulted in:



By integrating waste reduction into care pathways, Viborg demonstrates how decarbonisation and efficiency can go hand in hand in healthcare.

¹ The hospitals in the Capital Region of Denmark use about 1 million m3 of domestic water annually. Typically, 400-600 m3 per day is used in the larger hospitals. There are significant efficiency and savings potentials in the hospitals’ water flows. A saving on the consumption of tap water at Rigshospitalet of, for example, 10% will result in an annual saving of DKK 700,000 in savings on water and water drainage prices (Miljøstyrelsen, 2016).



Chapter 4

Case Study: Applying the Seven Levers of Change to Chronic Kidney Disease

Chronic kidney disease (CKD) is a significant public health concern with high environmental and economic costs. The environmental footprint of CKD care increases significantly with disease progression. Early-stage CKD can often be managed through lifestyle interventions and medication, whereas late-stage disease requires resource-intensive interventions, particularly hemodialysis, which consumes large volumes of water and electricity.

Chronic kidney disease

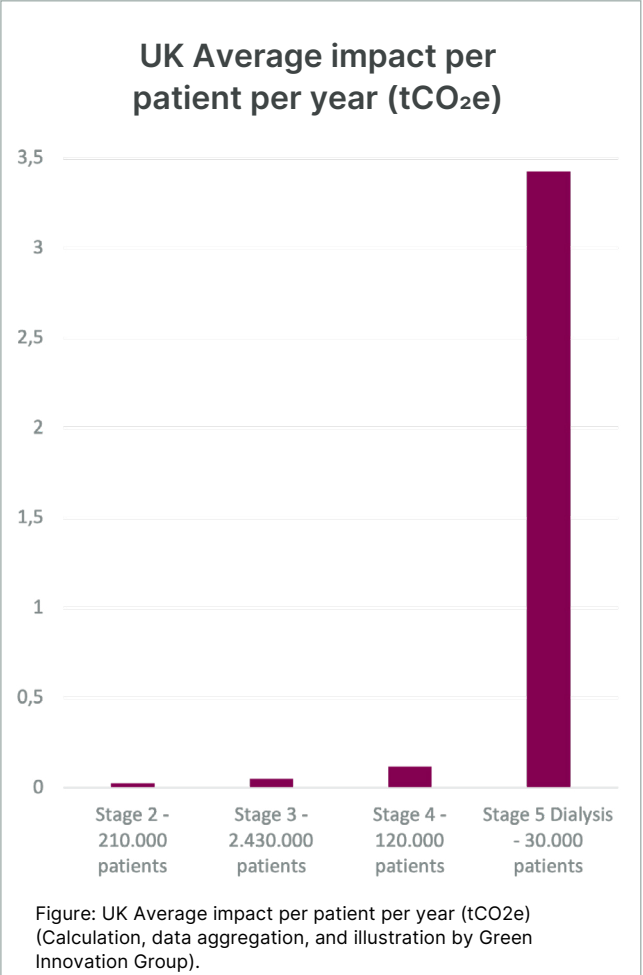
CKD is a progressive condition characterised by declining kidney function, leading to the accumulation of waste products and fluid imbalances. CKD often develops over many years and is frequently caused by underlying health conditions such as diabetes and high blood pressure. CKD is a long-term condition where the kidneys gradually lose their ability to function properly.

These conditions damage the small blood vessels in the kidneys, reducing their ability to filter waste effectively. In the early stages of the disease patients are often not experiencing symptoms, and hence are not diagnosed, even though simple and cheap urine tests and blood tests to screen for CKD are available. As kidney function declines, patients may experience symptoms like fatigue, swelling in the legs, difficulty concentrating, and high blood pressure, these symptoms are also present in a wide range of other diseases making CKD diagnosis more complex.

According to the National Kidney Foundation (2022): “In the United States, 37 million adults are estimated to have kidney disease, also known as CKD, and approximately 90 percent do not know they have it”.

About CKD

CKD is classified into five stages, ranging from mild impairment to end-stage renal disease (ESRD), where patients require dialysis or transplantation to survive. In Denmark CKD is described in 5 stages of severity (Herlev Hospital). Stage 5 CKD can lead to kidney failure, requiring dialysis or a kidney transplant to sustain life. Early diagnosis and treatment can slow the progression of the disease and prevent complications, making disease management and early intervention essential.



In Denmark, “it is estimated that up to 10% of the adult population has CKD, most of them mildly asymptomatic and therefore re undiagnosed, untreated and/or unaware. Just over 5000 people in Denmark are being treated for chronic kidney failure in stage 5 CKD, i.e. less than 0.1%” (Patient Håndbogen, 2024). At the end of 2023, 3244 patients were undergoing dialysis, including 20% peritoneal dialysis and 80% haemodialysis whereas 26% received treatment in their own home (DNSL, 2024).

Emerging evidence from environmental analyses of chronic kidney disease (CKD) care suggests that emission reduction opportunities exist throughout the disease trajectory — from early-stage management to more intensive treatment modalities.

The CO₂e impact per patient rises drastically when the disease progress to stage 5 where the treatment is very resource-intensive.

This is the CO₂e footprint in the UK across CKD stages

Annual CO₂e impact from CKD treatment in UK.
Total = 246.134 tCO₂e/year



Calculation, data aggregation, and illustration by Green Innovation Group.

Environmental Impact of CKD Treatment

A comprehensive life cycle assessment (LCA) of CKD treatment highlights the substantial environmental burden of advanced-stage care, particularly in-centre hemodialysis¹. The energy and resource demands of dialysis, along with its associated waste and transportation emissions, contribute significantly to the healthcare sector's carbon footprint.

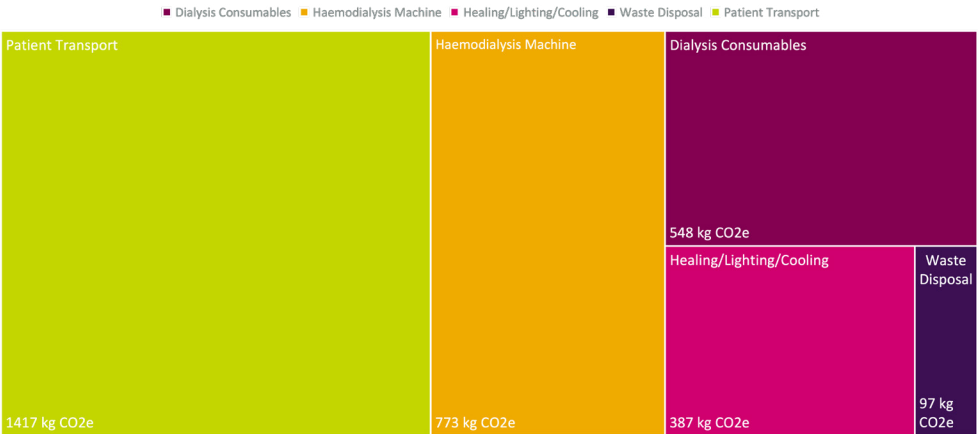
When adjusted for Danish energy consumption, in-centre hemodialysis has a carbon footprint of 3,221 kg CO₂e per patient per year, representing a 25% increase in carbon emissions for an average Dane² (Zoccali, et al., 2023). This underscores the urgent need to integrate sustainability measures across the CKD care pathway to reduce emissions without compromising patient care, early diagnosis and treatment to halt progression appears as a meaningful goal to pursue.

Breakdown of Environmental Impact in stage 5 CKD Treatment

- **Dialysis:** In-centre dialysis is both energy- and water-intensive, making it a major contributor to the carbon footprint of CKD care.
- **Transport:** Patients undergoing in-centre dialysis must frequently travel to and from treatment facilities, significantly increasing transportation-related emissions.
- **Consumables:** Dialysis relies on single-use materials and medical devices, generating between 1-8 kg of waste per procedure, amounting to 156-1,248 kg of waste per patient annually. For comparison, the annual household waste per Dane is 754 kg, meaning that dialysis can effectively double a patient's waste output³.

¹ Researching for this paper we have not found any LCA studies describing the emission from at-home-treatment for stage 5 CKD patients.
² NB this is estimated on a consumption-based model from CONCITO at 13t CO₂e per capita per year in DK.
³ 746 kg of waste per year per inhabitant (Miljøstyrelsen, 2024).

Annual carbon footprint from in-centre dialysis for 1 patient in Denmark



Calculation, data aggregation, and illustration by Green Innovation Group.

Decarbonising the CKD Care Pathway

Reducing the environmental footprint of CKD treatment requires a care pathway approach, where sustainability is integrated at every stage of disease management.

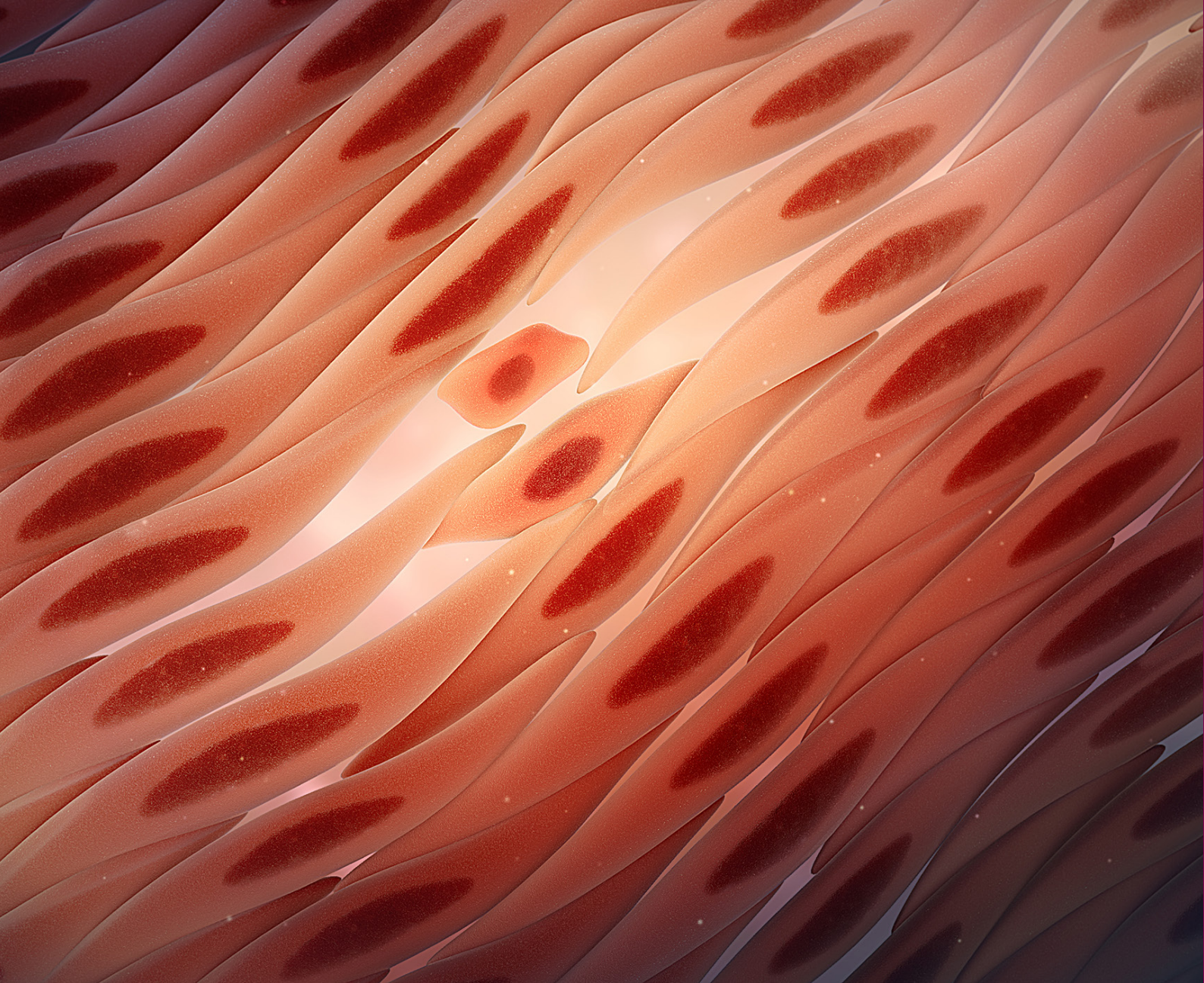
By rethinking the entire patient journey; from early diagnosis and prevention, optimising dialysis and long-term treatment, to procurement and ressource use, Denmark can curb emissions while ensuring high-quality patient care.

Early identification and guideline-based management of CKD can improve renal and cardiovascular outcomes and help reduce avoidable hospitalisations. It can also reduce wide range of other comorbidities. These outcomes affect both patient health and healthcare system emissions, underscoring the value of prevention (Nagai, et al., 2024). By not including the prevention of these resource and emission heavy co-morbidities, the current analysis of emissions is an intentional underestimation of the effect of early prevention.

1. Early Diagnosis and Prevention

Preventing CKD progression is one of the most effective strategies for reducing both the environmental and economic burden of treatment. Early detection through proactive screening for risk factors such as diabetes and hypertension, can help delay or prevent the need for intensive treatments like dialysis.

In addition, implementation of screening via UACR (urine albumin-to-creatinine ratio) and eGFR (estimated glomerular filtration rate) could potentially increase early diagnosis leading to initiation of treatment that prolong and prevent disease progression. By improving disease management in earlier stages, Denmark can significantly reduce the emissions associated with late-stage treatments while enhancing patient outcomes.



“At the Danish Kidney Association we fully support a focus on early detection and prevention of CKD to prevent disease progression and new patients. Still, we also have to look at what can be done on securing sustainability for the existing patient population who, given the chronic nature, will have to be treated for the rest of their lives. Due to a growing elderly population, many experts predict that we will not see a reduction of this specific number of patients from prevention but just a stagnation in the coming years.

Moving dialysis from the hospital to the patients home is not necessarily a “green” solution as it just moves the problem home to the patient. At the end of the day the environmental problem following dialysis it is still the responsibility of the Danish Regions.

Many patients with CKD also suffer from other chronic diseases like diabetes and cardiovascular diseases. In the current health system we are still treating them separate which is challenging for the patient as they have to move around the system a lot. Going forward it would make sense - also seen from a sustainability point of view - to treat these patients who suffers from more than one chronic disease as such.”



Michael Buksti
CEO, Danish Kidney Association

2. Optimising Dialysis

Transitioning from resource-intensive in-centre dialysis toward home-based modalities, such as peritoneal dialysis, can substantially lower the carbon footprint of CKD treatment.

Home dialysis eliminates the need for frequent patient travel, reduces facility energy consumption, and requires fewer consumables (National Kidney Federation UK, pg. 4-5, 2023).

Denmark can also explore green nephrology initiatives, such as water-conserving dialysis technologies, which have already been implemented in the UK and other European countries. These advancements could help mitigate the high energy and water consumption associated with conventional dialysis.

3. Sustainable Procurement and Resource Use

The Environmental Impact of CKD LCA Study emphasises the need for sustainable procurement of medical devices and consumables. Denmark’s healthcare sector can reduce waste and carbon emissions by:

- Implementing the “Green Staircase” framework from the Danish Regional Strategy for Green Hospitals, prioritising reusable materials where feasible.
- Collaborating with suppliers to source low-carbon dialysis consumables.
- Ensuring that sustainability criteria are included in public procurement tenders for dialysis machines and medical supplies.

Applying the seven levers of change to the CKD care pathway highlights opportunities to reduce emissions and improve patient outcomes. Prevention, early detection, and effective disease management are essential to lower the burden of disease progression and CKD Stage 5 treatment, which are the largest contributors to the carbon footprint of CKD care.



Chapter 5

Case Study: Applying the Seven Levers of Change to Type 2 Diabetes

The selection of interventions to reduce emissions while improving health outcomes will vary across care pathways. This case study examines how targeted actions in type 2 diabetes care can lower emissions while optimising patient outcomes.

While applying this analysis to other disease pathways is not always feasible due to limited data on care pathway carbon footprints, the methodology used here can serve as a foundation for further investigations. Even in cases where product- or treatment-level emissions data are unavailable, this framework can help generate hypotheses for future research.

Complications from diabetes

Diabetes complications place a significant burden on healthcare systems, requiring intensive medical interventions and increasing hospital admissions.

The disease often leads to problems in large and small blood vessels, contributing to eye disease, CKD, foot ulcers, heart failure, stroke, and myocardial infarction. These complications require intensive medical intervention and result in higher hospital admissions, placing a heavy burden on healthcare systems.

These complications not only worsen patient outcomes but also increase healthcare resource utilisation, making diabetes care a high-emission pathway. Prioritising effective diabetes management helps reduce the risk of these complications, improving outcomes and easing healthcare demands.

In Denmark, an estimated 360,000 people are living with type 2 diabetes in 2024 (Diabetesforeningen, 2024). While the prevalence of diabetes has been steadily increasing, Denmark's rates remain lower than those observed in the UK. This may be attributed to Denmark's robust public health policies promoting physical activity, a healthy diet, and a strong healthcare system focused on preventive care.

About type 2 diabetes

Type 2 diabetes is characterised by the body's inability to effectively use insulin; the hormone responsible for regulating blood sugar.

The condition is primarily managed through lifestyle interventions, medication, and regular monitoring. Treatment typically includes diet and physical activity to support metabolic health, and medications to help regulate blood sugar. If untreated, it can lead to complications like heart disease, kidney disease, stroke, or nerve damage. Weight loss and a healthier diet may help prevent or even put type 2 diabetes into remission.



Type 2 Diabetes Patient Care Pathway Footprint
144 kg CO₂e per year



Calculation, data aggregation, and illustration by Green Innovation Group.

Carbon Emissions Associated with Annual Treatment of Type 2 Diabetes

Modelling shows that complications - often managed in hospital - drive much of diabetes-related emissions. Preventing and better managing complications can therefore lower resource use and associated carbon impacts (Fordham et al., 2020).

Pharmaceuticals account for nearly one-third of the footprint, estimated at 49 kg CO₂e. Of this, 12 kg CO₂e comes from diabetes treatments specifically, while the remaining 37 kg CO₂e comes from other pharmaceuticals.

The total disease footprint is 144 kg CO₂e, and the top five contributors are:

- Disease management and complications (33.9%)
- Patient travel (20.7%)
- Testing (13.1%)
- General practitioners visits (4.3%)
- Raw materials (3.3%)

The model outlines the carbon footprint for the type 2 diabetes care pathway.



Reducing emissions requires a holistic approach

A holistic approach is required to reduce emissions across multiple areas. Focusing on single emission sources in isolation may be counterproductive, as effective prevention, early detection, and disease management can lower complications, hospitalisations, and overall resource use, ultimately reducing the carbon footprint while improving health outcomes.

The diabetes care pathway is well-defined in clinical guidelines, emphasising the need for early detection through blood glucose screening. Like many non-communicable diseases (NCDs), type 2 diabetes is largely preventable by taking actions, such as promoting healthy diets and physical activity, to address common risk factors.

Telehealth has seen many application for Type 2 Diabetes allowing for clinicians to monitor patients remotely on various biomarkers (Wu et al., 2019).

Seven Levers of Change Applied to Diabetes

The seven levers of change provide a structured approach to reducing emissions in diabetes care while improving patient outcomes. The greatest emissions reductions can be achieved by preventing disease progression and associated complications.

The environmental impact of managing advanced-stage kidney disease requiring dialysis is significantly higher than that of managing earlier stages of chronic conditions with less resource-intensive interventions. Emissions can differ by up to two orders of magnitude, depending on the type and intensity of treatment required.

A UK-based cohort study of 10.000 individuals with prediabetes found that 15% developed complications such as CKD or cardiovascular disease. Despite being a smaller subgroup, these patients contributed to 50% of the total lifetime emissions of the entire cohort.

Two low-cost interventions have been shown to significantly reduce diabetes-related emissions:

1. Primary prevention programs focusing on diet and exercise could lower CO₂ emissions by 5-34%.
2. Digital health apps for insulin-dependent diabetes management could reduce the risk of complications, leading to a 5% decrease in emissions.

A 2019 study found that digital health interventions improve blood sugar control in patients with type 2 diabetes (Wu, et al., 2019). It is estimated that:

- Adherence and lifestyle apps could reduce cardiovascular complications by 3%.

Applying the seven levers of change to the diabetes care pathway highlights opportunities to reduce emissions and improve patient outcomes. Prevention, early detection, and effective disease management are essential to lower the burden of complications, which are the largest contributors to the carbon footprint of diabetes care.

The Seven Levers of Change



Lever 1
Preventing disease onset



Lever 2
Diagnosing early



Lever 3
Optimising disease management



Lever 4
Improving the efficiency of intervention



Lever 5
Delivering care remotely or closer to home when appropriate

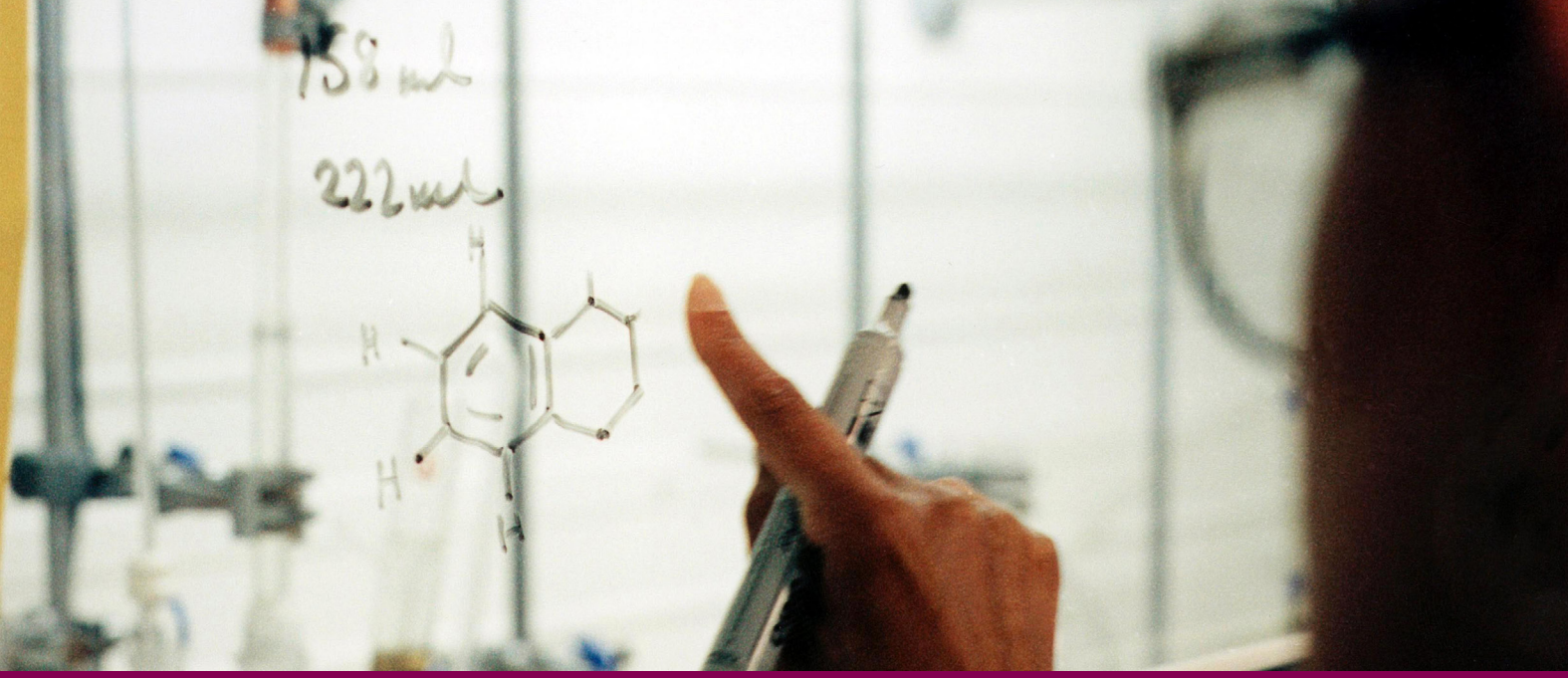


Lever 6
Using lower-emission treatments



Lever 7
Decarbonising Healthcare Facilities and fleets





Chapter 6

The Danish Health System Can Come Together to Decarbonise Care Pathways Across Regions and Municipalities

Achieving sustainable healthcare requires engagement and collaboration between providers, policy makers, and communities. To achieve the ambitious emissions reduction it is crucial that regions and municipalities align their healthcare strategies, integrate and share knowledge and best practices across the system.

This chapter emphasises the importance of a coordinated, multi-level approach to decarbonising healthcare, particularly in the management of chronic diseases. It outlines key focus areas – prevention, early diagnosis, and treatment adherence – and highlights the roles of healthcare providers, policymakers, and communities in advancing sustainable care practices. Regional and municipal collaboration is essential, especially as municipalities play a vital but currently non-mandated role in preventive healthcare. The Danish Regional Strategy for Green Hospitals offers a framework for knowledge sharing, and hospitals are encouraged to implement low-carbon practices, such as optimising patient flows and integrating telemedicine. Together, these efforts aim to enhance patient outcomes and reduce the healthcare sector's environmental impact.

Engaging Healthcare Providers, Policy Makers, and Communities

Achieving sustainable healthcare requires collaboration across all levels of the healthcare system, including healthcare providers, policymakers, and other stakeholders. A structured approach to care pathway decarbonisation should focus on three key areas:

- Prevention: Strengthening preventive healthcare efforts to reduce the incidence of chronic diseases.
- Early diagnosis: Detecting non-communicable diseases (NCDs) at an early stage, allowing for low-cost, effective interventions that prevent disease progression.
- Treatment adherence: Enhancing compliance with chronic disease treatments to reduce hospital admissions and lighten the burden on the healthcare system.

Healthcare providers are increasingly integrating low-emission practices into patient care, with telemedicine gaining traction as a tool for remote monitoring and treatment delivery. However, policy frameworks remain insufficient to drive system-wide sustainability efforts (Sundhedsstrukturkommissionen, 2024)¹.

In parallel, community-driven health initiatives such as programs that promote physical activity and healthy lifestyles can reduce disease incidence and lower the overall carbon footprint of the healthcare sector. A coordinated approach is necessary to ensure that sustainability efforts benefit both patients and the environment.

Regional and Municipal Collaboration for Sustainable Healthcare

To achieve meaningful emissions reductions, regions and municipalities must align their healthcare strategies and integrate sustainable practices across the system.

The Danish Regional Strategy for Green Hospitals provides a strong foundation for decarbonisation efforts within regional healthcare facilities. However, municipalities play a critical role in prevention and early intervention and currently, they are not mandated to provide preventive services for citizens at risk of chronic disease.

The Health Structure Commission has explicitly highlighted the potential for strengthening prevention services, particularly in areas where municipal and regional health services overlap. In this area, there will be a particular overlap with the citizen-oriented prevention services (Sundhedsstruktur Kommissionen, pg. 17, 306, 2024).

Costs for patient-oriented prevention cannot be calculated separately, as the initiatives are often integrated into other areas, including citizen-oriented prevention, estimates vary from 0,05% to 2,4% of the healthcare spending².

¹ Exemplified in the 2024 report from the Health Structure Commission where the following terms are absent across 420 pages: CO₂, Carbon, Climate, emissions, greenhouse gasses. However; "Prevention" is mentioned 189 times, "diagnosis" is mentioned 69 times and disease management is mentioned 22 times (Forløbsprogrammer), could it be unintentionally decarbonising?

² According to the municipal chart of accounts, the total expenditure on citizen- and patient-oriented prevention was DKK 1.3 billion in 2022 of the DKK 266 billion Denmark spends on healthcare annually. Dansk Statistik amount the prevention efforts in 2023 to DKK 6,64 billion.

Knowledge Sharing and Best Practices on Care Pathway Decarbonisation Across Danish Hospitals

Collaboration across Danish hospitals is critical to accelerating the decarbonisation of care pathways. By leveraging the national platform established under the Regional Strategy for Green Hospitals, hospitals can exchange knowledge, share best practices, and implement low-carbon interventions in clinical care.

Constructive places to start could be for chronic non-communicable diseases such as CKD, diabetes, heart failure, COPD, arthritis etc.

Hospitals can significantly reduce emissions by:

- Optimising patient flows to minimise unnecessary hospital visits and admissions.
- Integrating telemedicine to replace in-person consultations where possible.
- Standardising low-carbon treatment options and procurement practices across institutions.

By embedding sustainable healthcare practices across institutions, Denmark can drive system-wide decarbonisation, improving patient outcomes while contributing to nationwide sustainability goals.





Framework 1

Care pathway mapping and hypothesis development for emissions hot spotting

Chapter 7

Toolbox for Danish Regions and Hospitals to Engage in the Decarbonisation of Care Pathways

Decarbonising healthcare requires structured tools, methodologies, and collaborative frameworks that enable hospitals and regions to assess, plan, and implement sustainable care pathways.

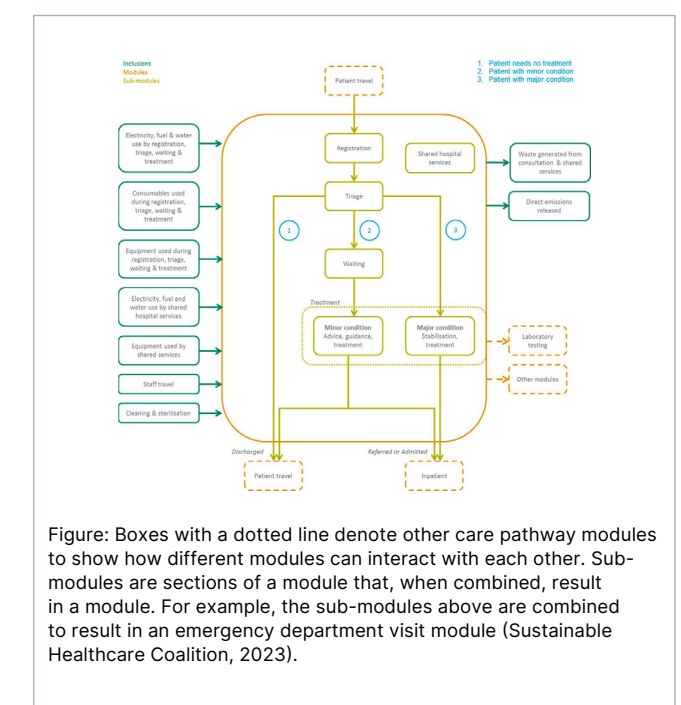
This chapter provides practical resources to guide Danish healthcare institutions in reducing the carbon footprint of patient care while maintaining high-quality health outcomes.

Care pathway mapping and hypothesis development for emissions hot spotting

Understanding the decarbonisation potential of a care pathway requires a detailed mapping of the patient journey. The SHC recommends the following steps to assess the environmental impact of a care pathway:

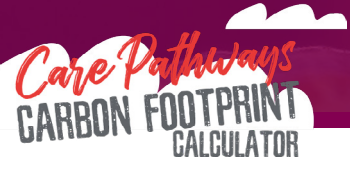
1. Define the objectives of the care pathway appraisal.
2. Define the care pathway to be appraised, including a draft of the activities required to provide the pathway.
3. Define the unit of analysis for the care pathway, which, as a minimum shall include patient type and representativeness, condition and severity, geographical coverage and age of the patient group.
4. Create a detailed map of the activities required in a care pathway by consulting literature and technical experts relevant to the pathway.
5. Group activities into modules to simplify the care pathway where possible, using guidance provided for modules in each of the separate module chapters.
6. Complete a materiality assessment to reduce the primary data collection requirements for the care pathway.
7. Calculate each module based on the guidance below and the information provided in each separate module chapter.
8. Add the correct multiples of modules together to develop an appraisal of the entire care pathway.
9. Interpret and report the findings, including any information that may be useful to improve the sustainability of similar care pathways.w

A detailed map of a module will include all relevant resources and emissions required to provide that module service. An example map of an emergency department visit is presented to the right (The Sustainable Healthcare Coalition, pg. 11, 2015).



Framework 2

Generic UK Tool for estimating Carbon Emissions



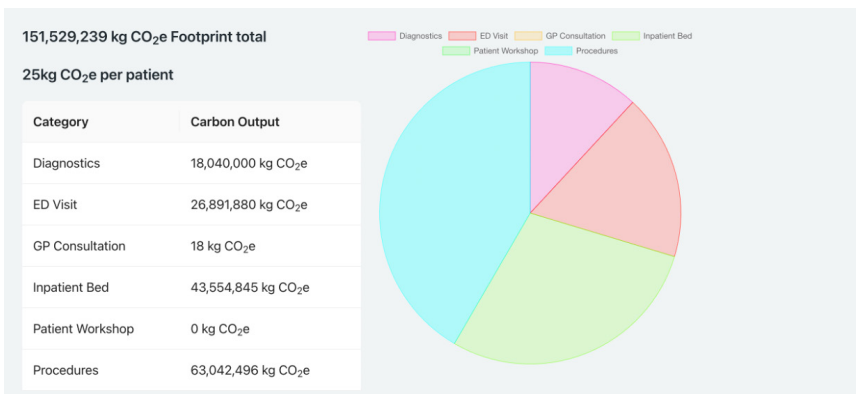
Generic UK Tool for estimating Carbon Emissions

SHCs Care Pathway Carbon Calculator provides a systematic approach for estimating carbon emissions across healthcare services.

The tool uses carbon footprint data, contained within the Sustainable Healthcare Coalition’s Care Pathways: Guidance on Appraising Sustainability. It uses a step-wise process to sum carbon from a number of separate activities (modules) associated with providing healthcare services to estimate the overall carbon footprint (kgCO₂e) for a specified pathway and patient population. Such calculations can be used to appraise the relative materiality of different activities and guide users to where greatest opportunity exists for reducing the carbon footprint of care.

It is important to note that the underlying data for this calculator originates from the UK, where the energy mix has higher CO₂ emissions than Denmark. Additionally, geographic differences may affect estimates for hospital energy use, patient travel emissions, and general practice operations.

Decarbonising care pathways in Denmark



This is a dummy example of what an output could look like using the calculator. This is an illustrative example built upon estimated average activities across the Danish healthcare sector from synthetic data (Developed by Green Innovation Group based on Sustainable Healthcare Coalition Carbon Calculator, 2025).

Framework 3

Stakeholder mapping for therapeutic areas

The stakeholder map for enabling decarbonisation of the care pathway for CKD in Denmark

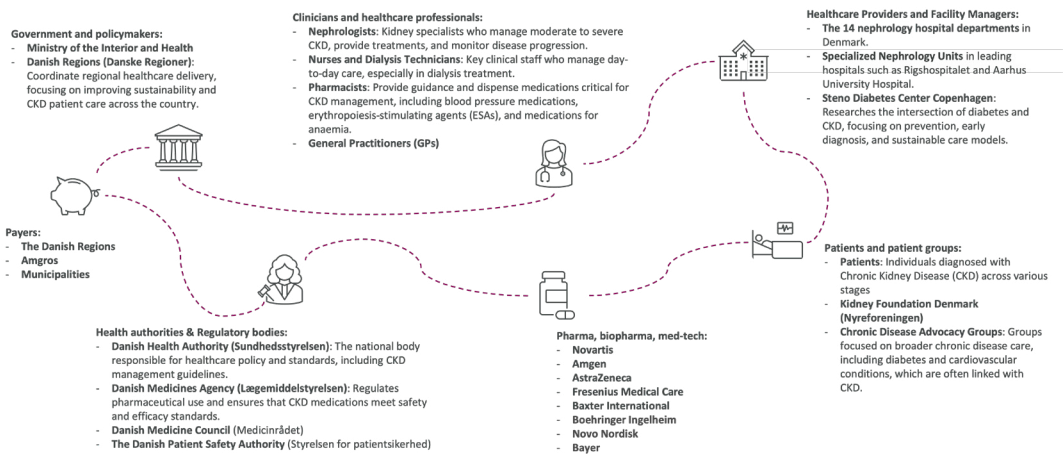


Figure: The stakeholder map for enabling decarbonisation of the care pathway for CKD in Denmark. Illustration by Green innovation Group.

Stakeholder mapping for therapeutic areas

Effective decarbonisation efforts require engagement across multiple stakeholders in the healthcare system. Stakeholders can be categorised into seven key groups, each with distinct roles, incentives, and areas of influence:

1. Government and policymakers
2. Payers
3. Health authorities & Regulatory bodies
4. Clinicians and healthcare professionals
5. Pharma, biopharma, med-tech
6. Providers & facility managers
7. Patients and patient groups

Framework 4

Practical solutions for early diagnosis, preventive care/medication and improved adherence

Practical solutions for early diagnosis, preventive care/medication and improved adherence

Despite the proven success of prevention, early diagnosis, and treatment adherence initiatives, these efforts remain fragmented across different disease areas in Denmark. There is no unified national strategy that systematically integrates preventive healthcare across therapeutic areas. For example, early detection programs have demonstrated high participation rates and positive health outcomes, yet they operate as isolated initiatives rather than as part of a cohesive strategy.

The Health Structure Commission acknowledges this, stating: “The sectors are mutually dependent on each other’s efforts, and there is a need for both early and preventive efforts, increased focus on early detection, and social and health professional support and treatment that is adapted to the individual’s conditions and needs. The efforts must take place across municipalities, regions and the general practice services” (Sundhedsstruktur Kommissionen, pg. 248, 2024).

Currently, the absence of a unified strategy risks undermining the potential of these preventive initiatives by limiting their scalability and consistency across the nation. A meaningful way to promote early diagnosis could be to combine screenings for patients that are at risk for multiple chronic disease, i.e. combining a rectal stool sample screening for cancer with a urine test for CKD.

Currently the cohesion between Retningslinier (guidelines) from the Health Authorities and the vejledninger (guides) from the medical societies are not always aligned and harmonised with diagnostics codes, Basislister and Forløbsplaner leading to suboptimal incentive structures from a health economics standpoint as well as a decarbonisation standpoint.

A more impactful healthcare system in Denmark requires a national strategy that explicitly incorporates prevention and early detection across therapeutic areas, such as a strategy that emphasise collaboration across healthcare sectors to ensure that preventive efforts are accessible, data-driven, and adaptable to the needs of diverse patient groups. A structured approach should facilitate better support for early diagnosis, improve adherence to treatments, and foster a healthcare environment where prevention is not merely an initiative but a fundamental pillar of the national health strategy.

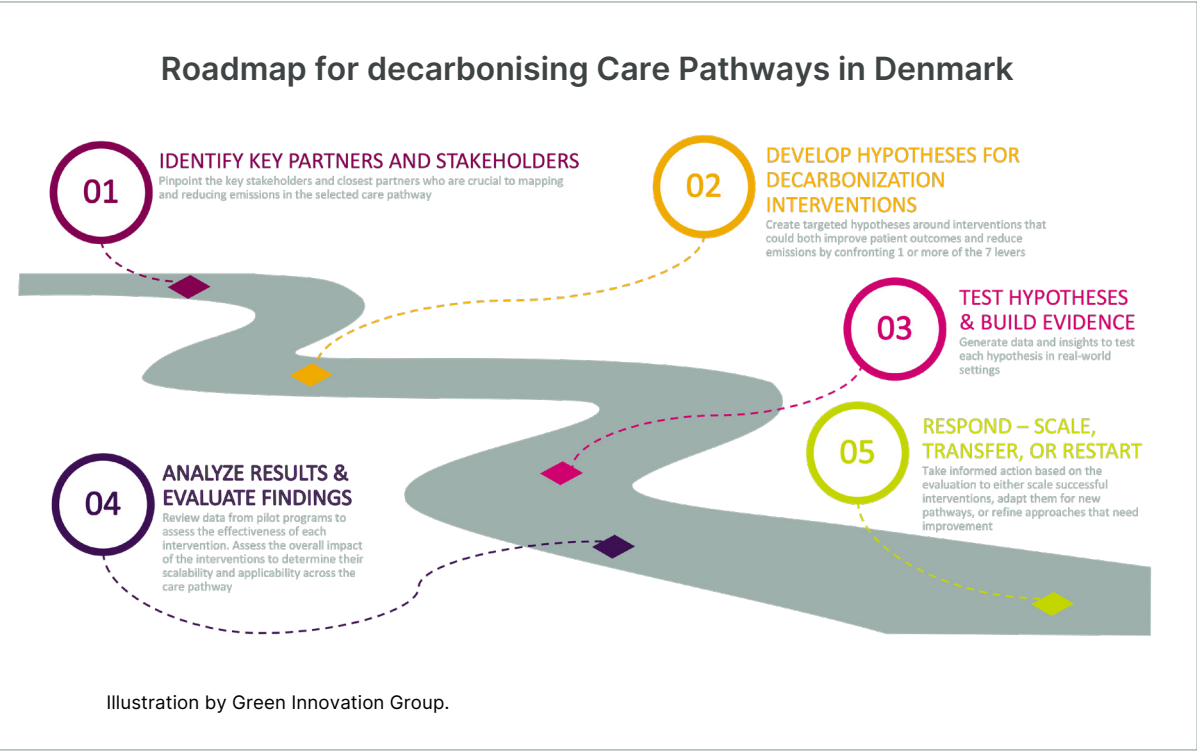


Roadmap to 2030: A Tactical approach to getting started with decarbonising care pathways

Transitioning to Sustainable Healthcare

The transition to sustainable healthcare requires a structured, evidence-based approach. This roadmap provides healthcare providers, policymakers, industry leaders, and patient advocacy groups with a step-by-step framework for initiating and scaling care pathway decarbonisation efforts. This methodology follows a five-stage process:

1. Identify key stakeholders and partners
2. Develop targeted hypotheses for emissions reduction
3. Test and generate evidence for proposed interventions
4. Analyse and evaluate results
5. Scale, transfer, or refine successful initiatives



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A microscopic view of several cells, likely lymphocytes, showing their nuclei and internal structures. The cells are stained and appear as bright, circular structures against a darker background. The image is used as a background for the document.

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