



Treating and Defeating Cancer

- the Swedish Way





An aging population in parallel with rapidly evolving technologies and drugs for treating cancer, poses both challenges and offers opportunities. The Swedish national cancer strategy forms the basis for development of cancer care since 2009. The strategy is based on the principle that care and nursing should be equitable and accessible to everyone throughout the country. The patient's needs should always be in focus. In Sweden, screening for many cancers is free of charge for everyone.

Swedish research is prominent in cancer treatment. Recent technological developments have led to more and better-quality health data being generated. Genome sequencing and imaging diagnostics make it possible to identify tumours and create conditions for individual treatment. Access to health data such as these provide an opportunity for future care and precision medicine to be introduced, not least in cancer care.

Sweden has several highly ranked innovation hubs in the sector. Many of our universities have research collaborations with companies and the public sector, which supports the conditions for clinical research and product development.

By sharing our experiences, we can support other countries and contribute to the fulfillment of the UN's third goal of sustainable development that states, "ensure healthy lives and promote well-being for all in all ages."

"The Swedish national cancer strategy forms the basis for development of cancer care since 2009"



Global Challenges

20 million people are affected by cancer globally each year, and almost 10 million die from the disease.

Cancer is the second leading cause of death in the world, but with geographical variations in incidence and mortality. Breast cancer and lung cancer have the highest incidence, and lung cancer dominates in terms of mortality. These variations are largely due to the age structure of the population, the presence of risk factors, access to preventive measures and the possibility of early detection, as well as access to good quality treatment.

Many cancers can be prevented, and early detection often involves much less extensive treatment. For types of cancer where screening programs are available (e.g. breast, colorectal and cervix), the chance of survival is higher, especially in countries with a higher HDI.

Most common cancers based on sex:

Female:

1. Breast
2. Colorectal
3. Lung

Male:

1. Lung
2. Prostate
3. Colorectal

Childhood Cancer

- » one of the most common causes of death for children worldwide
- » 160,000 children worldwide are affected each year
- » 90,000 children worldwide die each year
- » nine out of ten live in low- and middle-income countries.
- » Survival rates vary between countries and cancers from 5 to 85%

The Costs of Cancer

In addition to human suffering, cancer involves great financial cost. The exact global cost of cancer is unknown, but is estimated at hundreds of billions of dollars per year. This is divided into:

- » direct expenditure on treatment, care and rehabilitation,
- » indirect expenditure on loss of production due to sick leave and premature death,
- » hidden costs such as health insurance premiums and non-medical expenses.

Effects of COVID-19

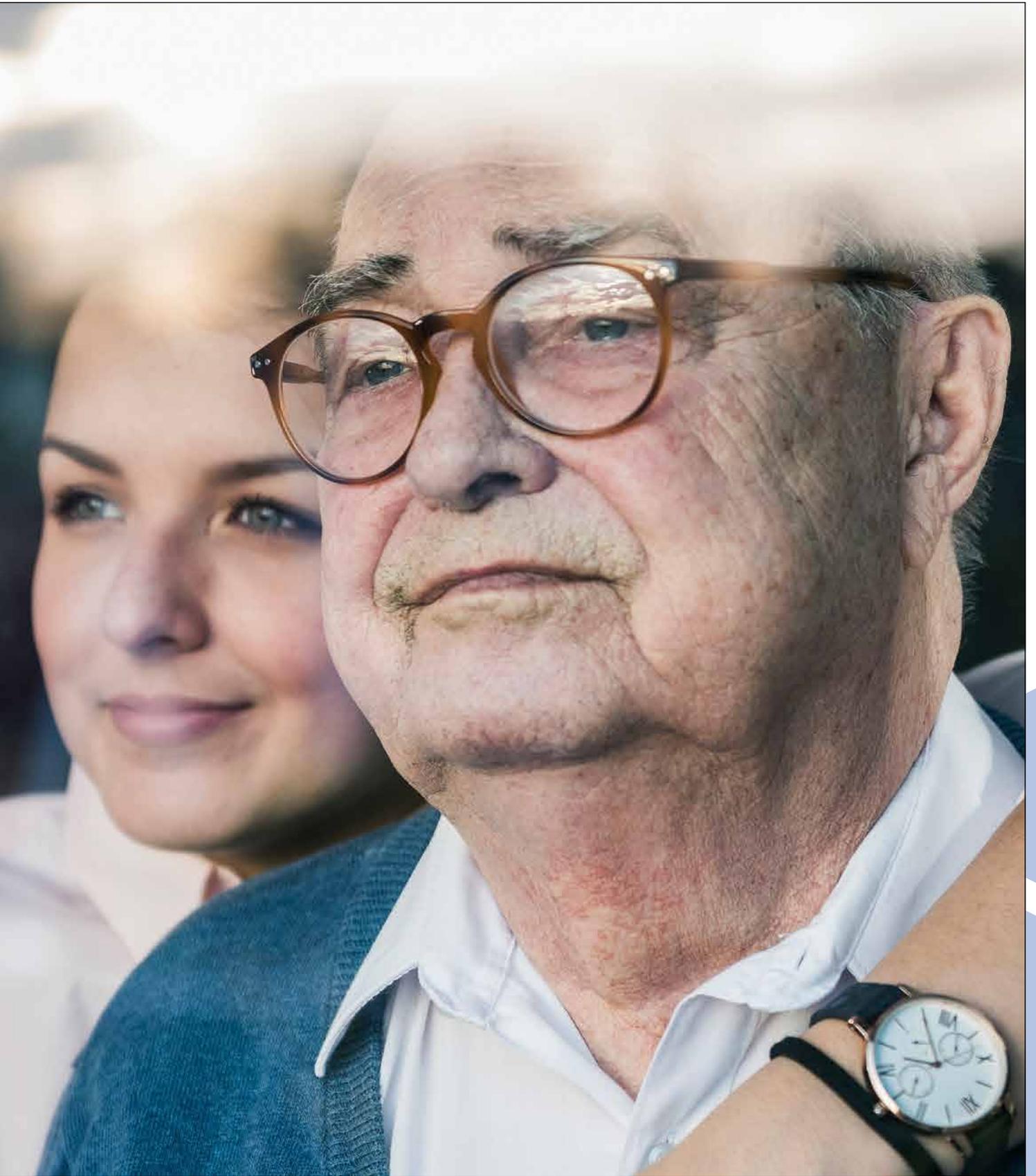
The COVID-19 pandemic has had profound effects on the diagnosis and treatment of cancer worldwide, with delays in diagnoses and far greater interruption or discontinuation of treatments in countries of all levels of prosperity.



We are a research and innovation milieu where actors across society engage in strategic collaborations to beat cancer.

We started in Sweden. Our ambition is global.

www.visionzerocancer.com



VISION ZERO CANCER

Financed by the Swedish
Innovation Agency



Swedish Strengths in Cancer Care

Swedish healthcare is of high quality and compares very well to that of other countries, achieving very good results for most diagnoses. In Sweden, 85 percent of children and 70 percent of adults affected by cancer are long-term survivors. Sweden is at the top for 5-year survival rates. Swedish strengths include:

Efficient healthcare provision

A well-developed healthcare system that contributes to equality in cancer care, regardless of geography, socio-economic group, age or sex. Care is based on need and enshrined in legislation regarding equitable and fair care.

- » A well-developed healthcare system that contributes to equality in cancer care, regardless of geography, socio-economic group, age or sex.
- » High competence and teamwork between all healthcare professions
- » Holistic view and patient perspective
- » Well-developed screening programs.

World-class research

Sweden has world-class research and research infrastructure. We invest heavily in life science-related research and have a comparatively large - and growing - proportion of highly cited publications.

Innovative life science industry

The life science industry is competitive, based on research, clinical activity and collaboration. The sector encompasses everything from large, well-established companies to an increasing number of small research-

based companies and innovative start-ups in drug development and manufacturing, biotechnology, medical technology and e-health-related products and services.

Well-established collaborations

Sweden has a longtime tradition of collaboration between healthcare, academia and companies. Swedish registers and social security numbers allow unique access to data. Many initiatives further improve collaboration such as innovations hubs and the development of high-tech data platforms.

The key actors:

- » The Ministry of Health and Social Affairs
- » The National Board of Health and Welfare
- » Swedish Association of Local Authorities and Regions, incl the Regional Cancer Centers
- » The Public Health Agency of Sweden
- » Swedish Medical Products Agency
- » The Dental and Pharmaceutical Benefits Agency

Scandinavian ChemoTech - Innovator in advanced cancer technologies and pain management

ChemoTech is an International Life Science company based in Lund, Sweden. The Company has developed a unique CE-marked technology platform that can be used to improve the uptake and clinical outcome for chemotherapy.



IQwave™ Advanced cancer care developed for both Humans and Animals



ChemoTech's patented TSE (Tumour Specific Electroporation) - technology uses a dynamic electrical pulse in combination with a very low dose of chemotherapeutic drug (5-10% of a complete treatment cycle). The TSE pulse opens the cancer cells' plasma membranes, which increases the passage and uptake of cytotoxic drugs and breaks down its DNA. TSE is developed to be less destructive than standard therapies and also makes it possible to treat non-responsive tumours. The dynamic feature of the TSE also favours therapies in sensitive areas as it creates less necrotic tissue.

ChemoTech 
When life science matters

www.chemotech.se

Knowledge Management

Many factors contribute to Sweden's good medical results in the field of cancer. One important factor is evidence-based care, which means that the care provider weighs its expertise with the best available knowledge and the patient's situation, experiences and wishes. Evidence and knowledge come from many different areas, and in Sweden we have systematised them in various registers, national guidelines, care programs and standardised care processes.

Quality registries

The approximately 100 Swedish national quality registries are a unique phenomenon. They collect national information about a specific disease or treatment, and are used to evaluate and improve care, produce statistics and assist in research. There are 18 registries in the field of cancer. The Swedish Cancer Register was established in 1958 and covers the entire population, registering about 60,000 malignant cancer cases per year. It contains data about the patient, medical data and follow-up data.

National guidelines

National guidelines support decisions on resource allocation in healthcare and social services with the aim of contributing to a higher standard and offering equal care in all regions.

Standardised care processes

In order to create equitable, high-quality care throughout the country and shorten the waiting time for investigation, diagnosis and treatment, standardised care processes have been developed, with 31 care processes within cancer care. They provide recommendations for investigation, treatment, nursing, rehabilitation and follow-up of patients. Patients' quality of life and satisfaction with care is improved and care becomes more equitable when the patient is involved and informed about what is happening.

An example can be found here:



Decision support system

To utilise the knowledge that the data collected can provide, AI-based diagnostic tools and digital decision support are increasingly used. Diagnostic tools and decision support based on large amounts of data helps improve the quality of care.

National specialised medical care

In Sweden, advanced diagnostics and treatment of 10 unusual and/or complicated cancer diagnoses are concentrated through national assignments at the country's seven university hospitals. This leads to more resource-efficient treatment, increased quality and patient safety and development of healthcare knowledge.





Precision monitoring in personalized oncology

AroCell is dedicated to help oncologists make faster and more informed decisions in cancer care

The AroCell TK 210 ELISA is a rapid and reliable diagnostic tool that can provide clinicians with information that can greatly improve the treatment decision by measuring the concentration of TK1 biomarker in serum.

TK1 - a unique biomarker in cancer management with the potential to improve survival rates and quality of life for cancer patients, but also reduce costs in the healthcare system.

For more information go to arocell.com or Contact:

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Competent Staff and Patient Focus

Teamwork

Teamwork is a big part of the success in Swedish cancer care. Cancer care chains are very complex and involve many specialties. Care staff collaborate in multidisciplinary teams to find the best treatment plan for each patient from the range of options available.

The patient at the center

Thanks in part to Sweden's publicly funded care system and central knowledge management system, with clear policies on patient influence, Sweden is far ahead internationally in terms of enabling the introduction of person-centered care. This means collaboration to give the patient the right care at the right time, while also giving the patient the security required.

Read more about person-centered care at Sahlgrenska Pediatric Cancer Centre:



Patient contract for a coherent care plan

Through a patient contract, an agreement is made between the patient and the care service for coherent planning of all the patient's care and nursing interventions. This strengthens the patient's participation and collaboration, and improves accessibility and coordinated planning.

Person-centered care involves a partnership between patients, relatives and professionals in treatment, care and rehabilitation. The patient is seen as an individual with unique needs, experiences and resources, who is included in all care decisions and processes as far as possible. This leads to better self-care and better cooperation between care units.



Patient overview

To date, a system of individual patient reviews has been introduced for eight cancer diagnoses, and several more are in development. These give a comprehensive and clear digital visualisation of the cancer patient's care and treatment. The patient can enter information about their condition themselves, which offers both patients and care staff a better overview of the course of the disease, treatments and mood.

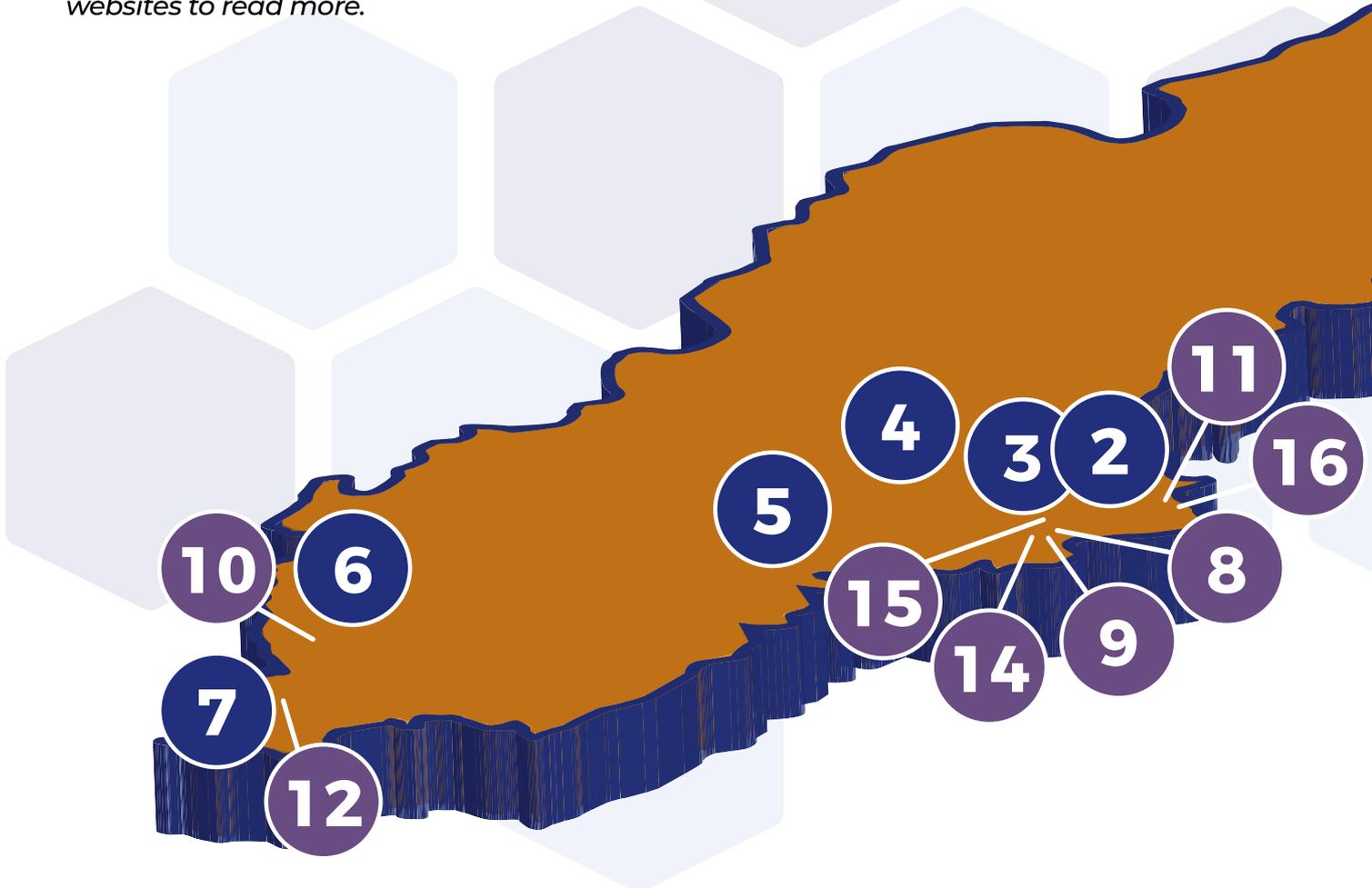
Patient-reported measures are also gathered systematically, and have led to improved communication, earlier detection of recurrence and improved quality of life in patients. 87 percent of respondents are content with the care provided, especially when it comes to information, competence of staff, continuity of care and respect.

Patient associations

The Swedish Cancer Society, the Childhood Cancer Fund and various associations for specific cancers are important organisations that work to fight cancer, support cancer research through fundraising and ensure that cancer patients and their relatives receive the care and support they need. Ung Cancer (Young Cancer), for example, provides support to young adults between the ages of 16 and 30 and works for a seamless transition from childhood cancer care to adult care.

University Hospitals and Important Centres

Healthcare, medical research and training of healthcare professionals is conducted at the Swedish university hospitals. Read more about each hospital strengths and visiting their respective websites to read more.



University Hospitals:

1. University Hospital of Umeå (Norrlands universitetssjukhus)

- » Radiotherapy e.g. for Prostate cancer using a precision gold-marker technique
- » National radio-chemotherapy centers for anal cancer

2. Uppsala University Hospital

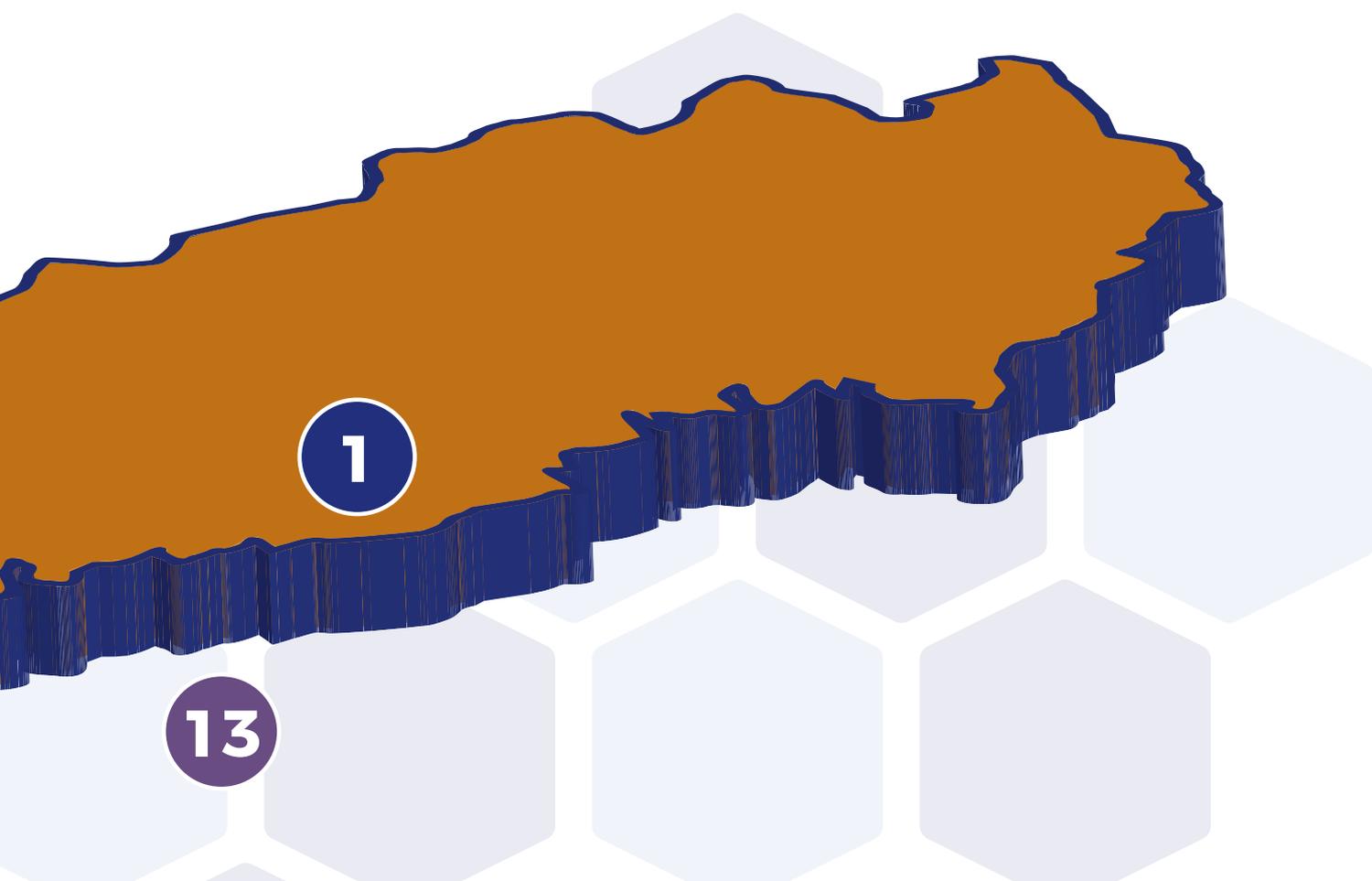
- » Endocrine tumors - a world leading center for diagnosis and treatment of neuroendocrine tumors
- » Radiation therapy (personalized radiation therapy through the unique MR-linac)
- » Proton beam therapy

3. Karolinska University Hospital and Karolinska Institutet

- » Brain Tumors
- » Hematological Tumors and Stem Cell Transplantation
- » Gynecologic Cancers
- » Pediatric Cancers
- » Cancer Research

4. Örebro University Hospital

- » Electro-chemo therapy for head & neck cancer
- » Brachytherapy for gynecological cancers
- » Advanced treatment of penile cancer



5. Linköping University Hospital

- » National center of excellence for vulvar cancer
- » Robot surgery - pancreatic cancer and urological malignancies
- » Hepatobiliary cancer surgery
- » Regional center for CAR-T cell therapy
- » Regional center for brachytherapy of gynecological cancers

6. Sahlgrenska Cancer Centre

- » Pediatric cancers
- » Breast cancer
- » Malignant melanoma through Isolated Limb Perfusion
- » ATMP, immunotherapy incl CAR-T and Electrochemotherapy

7. Skåne University Hospital

- » National center of excellence for penile cancer
- » National center of excellence for vulvar cancer
- » Advanced surgery of esophageal cancer
- » Anal cancer
- » Treatment of tumours spread to the abdominal cavity

Other important Centres:

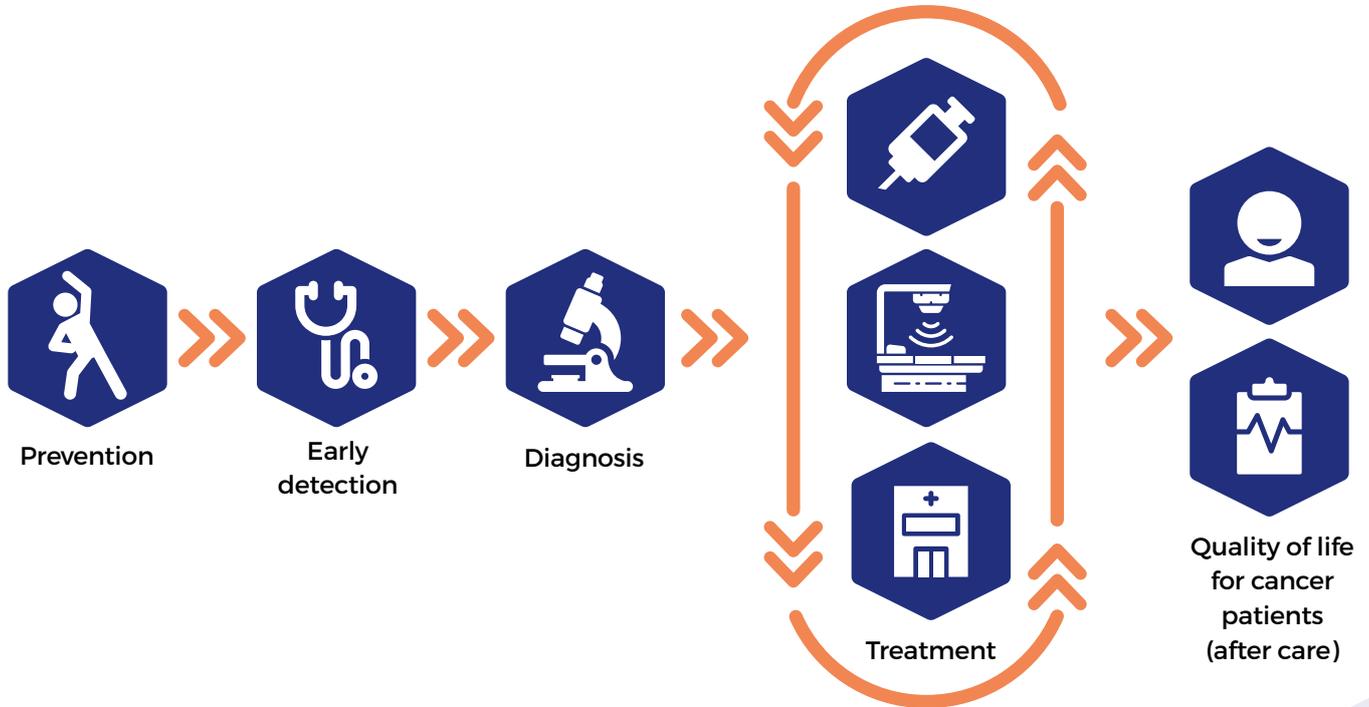
- 8. Skandionkliniken
- 9. National network AIDA
- 10. BioVenture Hub
- 11. Testa Center
- 12. Max IV
- 13. Nationella nätverk
- 14. SciLife Lab
- 15. GMS - Genomic Medicine Sweden
- 16. Biobank Sverige

View the interactive map here:



Patient Journey

To illustrate the many challenges in cancer care, we have chosen to highlight the patient journey on the following pages. This journey begins even before one becomes a cancer patient, with preventive measures, via early detection, diagnosis, treatment for survivor's quality of life and palliative care.



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Novum**

With **Zero
leakage** in
mind

CarpoNovum, Halmstad, Sweden, has conducted research and development of instruments used for colorectal surgery since 1996. Our ambition has been to overcome the major problems of anastomotic leakage and stenosis.

Clinical studies have been conducted in Sweden, Denmark, Germany and China the last 15 years. To date, 167 patients have undergone surgery with leakage less than 2% compared to 8.6%* with conventional surgery. No stenosis has been identified at follow-up.

- C-REX is based on a short-term implant that stays inside the intestines for 10-12 days and then leaves the body the natural way.
- The instruments used are called LapAid for colon surgery and RectoAid for rectal surgery.
- The catheters connected to the implant provide a unique opportunity to validate the anastomosis during and after surgery in real time.

C-REX is of course CE-marked and certified according to ISO 13485.

www.carponovum.com

* Results of the international audit by the European Society of Coloproctology (2017)



“Prevention is an underutilized potential, with benefits at different levels: for society, for healthcare and for the patient. There are no losers.”

- Ellen Brynskog, RCC West



Prevention

For both patients and the health economy, it is important to focus on prevention. More than 30 percent of all cancer cases are considered preventable, and Sweden has long excelled at prevention through classic public health work.

Preventive measures against ill health are enshrined in the Swedish Health and Medical Services Act and in national guidelines. Cancer control must promote health by integrating health-promoting perspectives into everyday care. We need new thinking, to reorganise and find alliances outside of healthcare, for that is where human health is largely shaped.

In addition, new risk estimation models with follow-up screening and new methods such as 3D mammography are being developed. Precision health, such as gene sequencing and individualised preventive measures for risk groups, can also contribute to new conditions for preventive measures.

Prevention can be divided into health-promoting initiatives as well as prevention at the individual, risk group and population levels. Structured interventions make it possible to identify patients with an increased risk of cancer as early as possible.

Example of prevention in Sweden:

- » Vaccination of both girls and boys in Grade 5 against HPV-related cancer, which provides an opportunity to eradicate cervical cancer. School nurses have administered this vaccination to girls since 2010 and to boys since 2020.
- » Physical activity on prescription (PAP) for patients at risk, and based on patient-centered, individualised counselling. Physical activity can also be prescribed for treatment purposes in connection with cancer treatment or rehabilitation.
- » Innovative models for procurement, reimbursement and social outcome contracts, for investment in prevention and early intervention with a clear focus on results. Sweden has an advantage here as the public sector is often involved in both financing and implementation of such programs.

Case Study: PREDICT

PREDICT is a strategic initiative aiming to use existing blood bank samples to find blood-based biomarkers at an early stage in order to prevent or alleviate diseases such as cancer. Its three aims are:

- » Measure biomarkers in order to detect disease early
- » Map diseases before diagnosis as a basis for new treatments
- » Study which factors control comorbidity

Listen to PREDICT project lead Beatrice Melin, and read more about the case here:



Early Detection

The role of primary care

Over 70 percent of Swedish cancer patients start their journey through the care chain in primary care.

Doctors in Swedish primary care are specialists in general medicine. They are supported in their work by such resources as standardised care pathways and digital tools.

Screening

Sweden's first cancer screening program started in the 1960s, for cervical cancer. Today, there are screening programs for breast and colorectal cancer, and more organised and extended PSA testing is being introduced for prostate cancer. There are proposals to introduce screening of specific high-risk groups and individualised screening based on risk assessment models that, for example, combine information on genetics, lifestyle factors and biomarkers. The use of biomarkers for early detection of cancer is under rapid development and supported by the Swedish government.

Cervical cancer

Gynecological cell sampling is offered to women aged 23-64. As a result, the disease has become significantly less common in the last 40 years. Together with vaccination against HPV-related cancer for girls and boys, the hope is to eradicate cervical cancer in Sweden.

Breast cancer

Studies show that women who participate in the mammography screening program reduce their risk of dying from breast cancer by up to 50 percent. All women aged 40-74 are called for screening. Future screening can be made more efficient through individual adaptation and better diagnostics.

Colorectal cancer

Sampling for early detection of colorectal cancer, the third most common type of cancer among both men and women in Sweden, provides the potential to cure almost all patients when it is detected in its pre-stages. Screening is therefore now being introduced gradually in Sweden for everyone aged 60-74.

Digital support for early detection

Digital tools are increasingly used for decision support and early detection. One such example is CaPrim (Cancer in Primary Care), a competence network under the Vision Zero Cancer programme. In collaboration with AstraZeneca, the project introduces digital clinical decision support for the uniform care of patients with suspected prostate cancer, in order to support primary care in referrals.

The decision support for referral for prostate cancer is developed in accordance with the standardised care process for prostate cancer, to help determine whether there is a well-founded suspicion of prostate cancer.

The Skåne and Stockholm regions both implement a teledermatology platform, where primary care physicians and specialists can document and photograph skin changes with a mobile phone and send them to dermatologists for assessment and diagnosis of skin cancer. The total cost can be reduced, but most importantly, diagnoses are made much faster than before.

Digital pathology

Digitalisation of pathology is groundbreaking for early detection and leads to increased quality, shorter queues and better access for all individuals to high-quality diagnostics within a reasonable time, through quicker and easier access to specialists. Using resources better and balancing peaks and troughs in volumes between hospitals also leads to cost savings.

Digital tools are also more accurate than analog and make it possible to go back and conduct quality monitoring of samples in a completely different way than under a microscope. It also enables the use of image analysis and artificial intelligence, something that the Centre for Medical Image Science and Visualisation at Linköping University is now developing, including in collaboration with the company Sectra. Read more about this groundbreaking technology:



SECTRA

Knowledge and passion

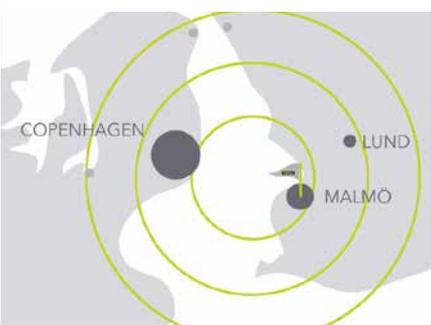


Medeon Science Park offers dedicated business development and a creative environment for both early-stage and established companies.



An ecosystem in diabetes

- Diabetes Samverkan Sverige (*Diabetes Alliance Sweden*) – project management
- World Diabetes Day – organizer
- Diabetes Center – process initiation, collaboration between healthcare, academia and business
- LUDC Lund University's Diabetes Center – close partners
- Diabetes Focus Team – support for SMEs
- The Medeon Prize – focus on diabetes, awarded annually



The Science Park in Malmö, in the center of Greater Copenhagen and in the heart of Medicon Valley.



Our focus is on knowledge-intensive Life Science companies: pharmaceutical development, medical technology, biotechnology and health-care



Forskaren (Researcher), 4,000 new m² at Medeon



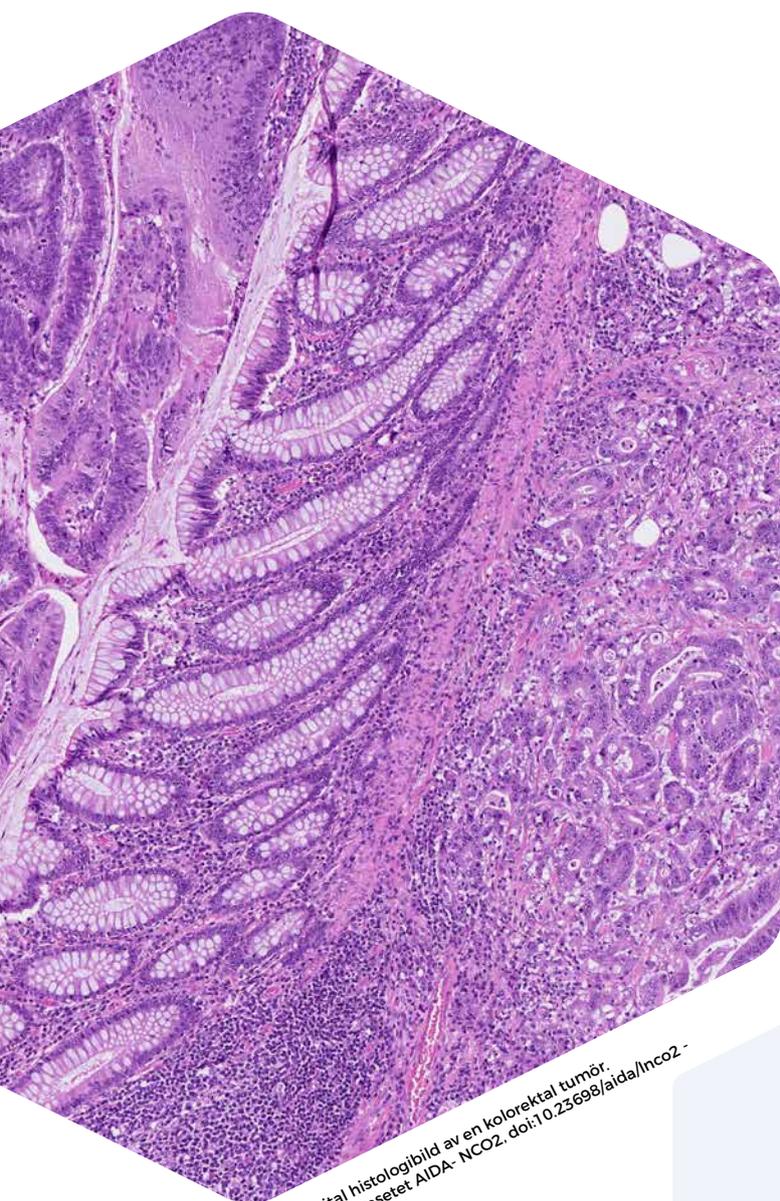
www.medeon.se

Case Study: Colorectal Cancer

Standardized care processes have been introduced to create equal and high-quality care with shorter lead times throughout Sweden. They serve as a template for determining the investigations to be conducted and maximum lead times for the various steps.

When the standardised care process for colorectal cancer was introduced nationally in 2016, the Stockholm region realised that a change in working methods and better coordination was needed in order to comply with the process and the number of stipulated days. A project led by consultancy com-

pany Centigo was initiated to map and understand flows, lead times, quality and volumes linked to colonoscopy. It also aimed to improve referral quality, introduce quality indicators and build a structure for continuous quality improvement. The project resulted in a number of quality-enhancing measures, freeing up resources and saving costs. Read more about the project, its work and its success factors and challenges:



Digital histologibild av en kolorektal tumör.
Från datasetet AIDA- NCO2. doi:10.23698/aida/nco2 -



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Hematology



Diabetes



Infection

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“Precision medicine means that we gain a far more precise understanding of diseases, which offers us completely new opportunities to make diagnoses and find individual treatments for each patient. This requires large amounts of data from individual patients, so we have to work in other ways, with many different skills and add other information to get an overall picture.”

- Anna Martling, Dean and Professor at KI, also Chief Physician and Surgeon at KS

Diagnosics

Diagnosis is the cornerstone of treatment, obtaining as much information as possible about the type of cancer, its spread, etc., enabling us to adapt the treatment. The major advances in research made in recent years have created the conditions for modernisation and more individualised healthcare – so-called precision health.

Precision health combines individual risk with more detailed studies of various diseases, thereby creating the environment for more tailored treatments. This offers enormous potential for earlier detection, more advanced diagnostics, better treatments, the chance of fewer side effects and even a cure.

Sweden is a leader in several areas of precision medicine and the Swedish government is making major investments in this area. At the same time, Swedish healthcare is increasing the pace of transformation to achieve a broad introduction of more individualised care. We have unique conditions, including access to data from various registers, traceability through social security numbers and well-established high-tech platforms for data management. Precision health entails a paradigm shift for healthcare, making collaboration with research and the private sector as an integrated part of healthcare provision a necessity.

Genetics

Genetics is a central part of precision medicine. Gene sequence-based diagnostics are already used today to identify optimal treatment for certain cancers. For e.g. melanoma, lung cancer and breast cancer, genetic mappings are regularly performed in Sweden to detect special changes in a tumour’s genetic makeup so that the right targeted treatment can be initiated.



Coordinating such more precise mappings offers a greater basis for research, which can be linked back to healthcare and to patients more quickly.

As growing children are more sensitive to extensive cancer treatment, more accurate mappings and diagnostic investigations are carried out in pediatric cancer care. In this way, the most gentle treatment can be chosen with as few negative side effects as possible, without compromising on the goal of curing the patient.

Advanced imaging diagnostics

Modern advanced imaging provides an opportunity to detect very small changes, which can then be used to both make a diagnosis and monitor the effects of treatment. AIDA (Analytic Imaging Diagnostics Arena) is a national arena for research and innovation in medical image analysis, aiming to translate AI innovations into actual use in clinical routines.

Read more about AIDA here:



Data analysis

Sweden has good access to high-quality data and a well-developed infrastructure for data analysis, both important prerequisites for the implementation of precision medicine. Health data is used both as decision support for the patient’s continued treatment and as a valuable resource for research and innovation.

Case Study: KI and the Stockholm Region

Karolinska Institutet and the Stockholm Region have set up a task force for the development of precision medicine. The focus is on three areas:

Seamless organisation between research, healthcare and industry in order to shorten the time taken from research to the clinic. In addition, administrative adaptations are needed, such as reimbursement models, staffing and opportunities to share clinical data.

Data management – ensuring that data storage and computing capacity developed in healthcare takes the specific requirements of precision health into account. Advanced infrastructure and technical expertise must be integrated with clinical expertise for accurate and secure interpretation of data and rapid implementation of results in treatment.

Diagnostic development to allow learning from and using methods in areas such as genetics, proteomics, image analysis and lab samples.



Case Study: Genomic Medicine Sweden (GMS)

Sweden is a pioneering country in the roll-out of precision medicine, and the national GMS initiative has a key role in strengthening Swedish healthcare, research and collaboration in precision medicine with the business community. Collaboration is a key word: healthcare throughout the country must have access to the genetic tools that form the basis for diagnosis and treatment.

“We have already introduced broad gene panels for blood cancer at the national level. Our hope is that most cancer patients will have access to these new types of genetic analyses within the next 5 years,” says Richard Rosenquist Brandell, professor of clinical genetics at Karolinska University Hospital and chairman of the GMS management team.



We are leading a revolution in oncology to redefine cancer care

Our ambition is to provide cures for cancer in every form. We are following the science to understand cancer and all its complexities to discover, develop and deliver life-changing treatments and increase the potential for cure.



AstraZeneca is part of the global Lung Ambition Alliance

Lung cancer claims almost 10 lives every day in Sweden*, and is the leading cause of cancer-related death both in Sweden and globally¹. The Lung Ambition Alliance, a global coalition with partners across disciplines in over 50 countries, was formed to combat lung cancer through accelerating innovation and driving forward meaningful improvements for people with lung cancer.

Vision Zero Cancer – a Swedish innovation environment

In Sweden, Vision Zero Cancer was established in 2019. This is an innovation environment with public funding from Vinnova, initiated by The Swedish Municipalities & Regions, SKR, AstraZeneca, the Stockholm School of Economics, Elekta and Centigo. The initial focus was lung cancer and since the start, Vision Zero Cancer has run around 50 meetings and workshops with close to 100 participants, 3 international meetings and initiated 10 projects.

Become a part of the Innovation

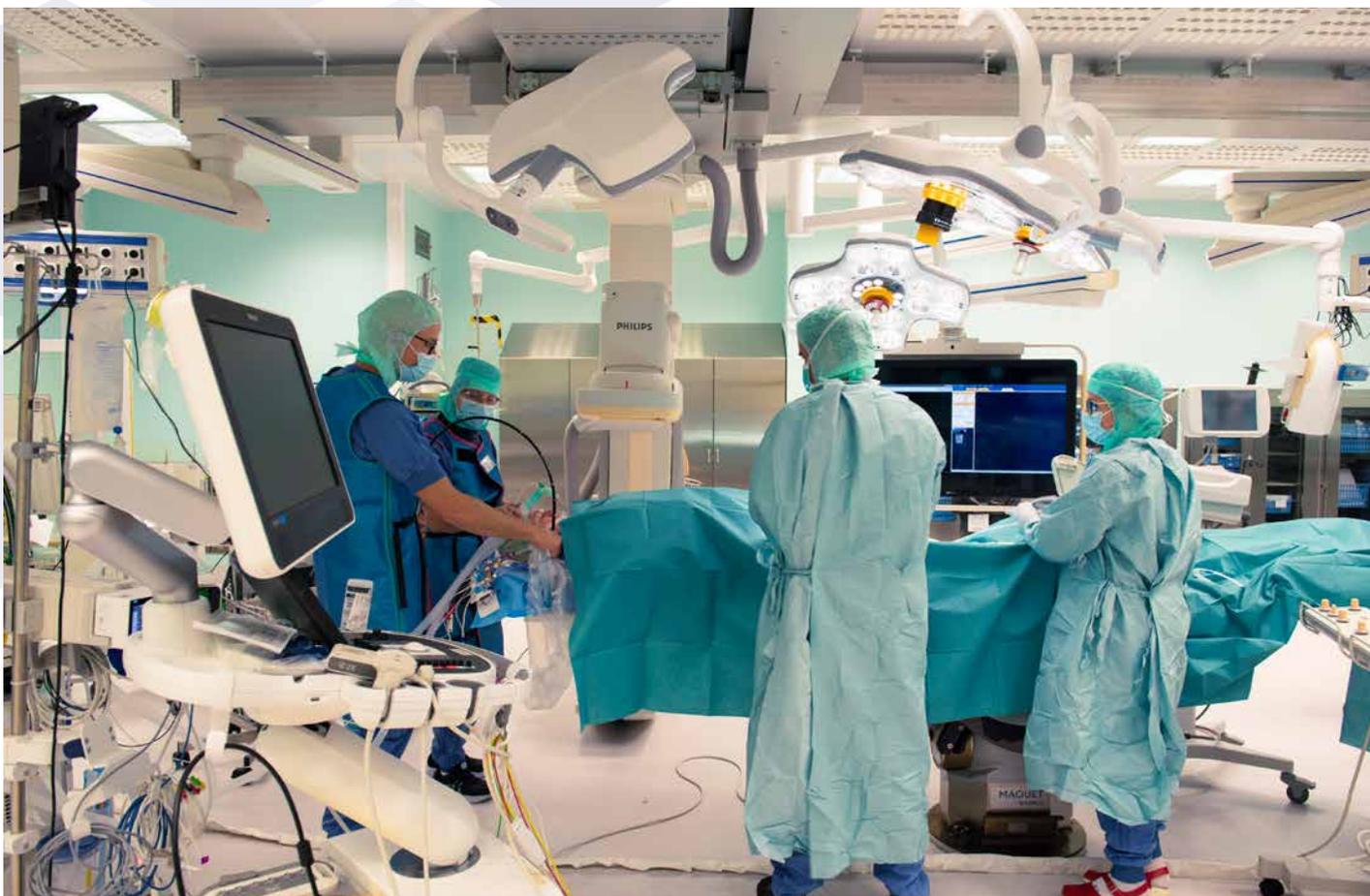
Together we can create even greater benefit for patients and society, in Sweden and globally. More stakeholders are welcome to engage through collaborations in specific actions and through partnerships, visit lungambitionalliance.com and visionzerocancer.com to learn more.



AstraZeneca, 151 85 Södertälje

* = Year 2019, 3556 deaths from lung cancer

1. <https://www.folkhalsomyndigheten.se/folkhalsorapportering-statistik/tolkad-rapportering/folkhalsans-utveckling/resultat/halsa/lungcancer-dodlighet/>



Medical team performing surgery at Karolinska University Hospital.

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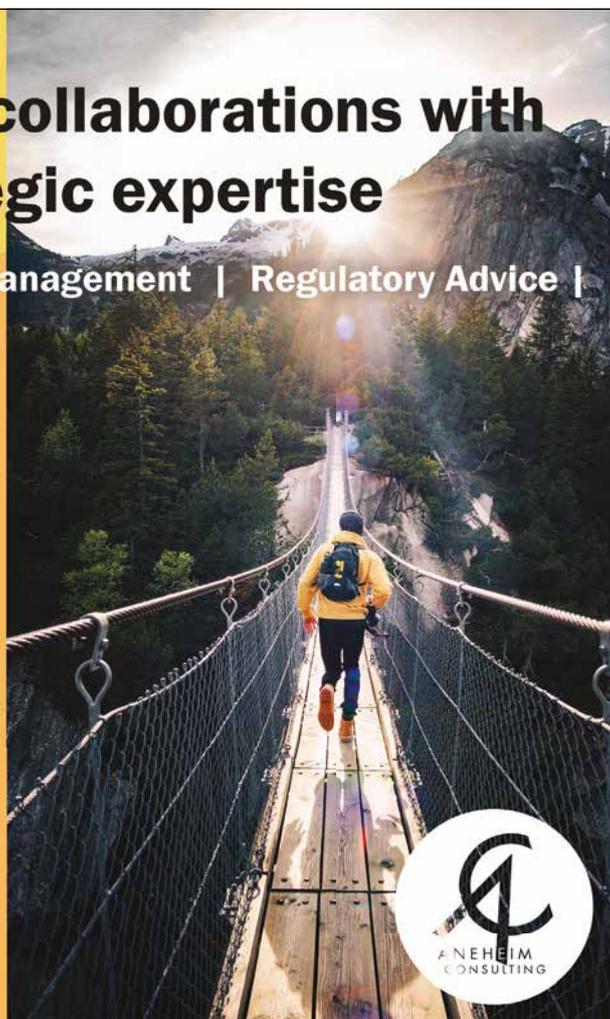
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Treatment: Surgery and Drugs

Treatment usually involves radiation therapy, chemotherapy and/or surgery. Combination therapies, with two or more different drugs or with medical devices, have contributed to a better and longer-lasting response for many cancer diagnoses. Today, cancer treatment is often carried out without patients having to be admitted to hospital. Newer forms of treatments such as targeted therapy and immunotherapy are today used for some cancers.

Surgery

Removal of the tumor is an important measure in the treatment of most cancers, for example in colorectal cancer. Surgery is often combined with drugs or radiation therapy. Developments in surgery in recent decades, such as robot-assisted procedures, have led to less extensive surgery and a shorter recovery time for the patient.

Chemotherapy

New, more specific chemotherapy treatments have been developed that kill cancer tissue without damaging healthy tissue, resulting in increased efficacy, fewer side effects and preserved quality of life.

Advances in recent years have increased our understanding of various cancers at the cellular, molecular and gene levels. This includes the introduction of Advanced Therapy Medicinal Products (ATMP) based on cells, tissues or genes, as well as combination drugs. The Swedish Medical Products Agency and the Swedish regions work systematically to give all patients faster and equal access to new, valuable treatments, motivated by health economics.

Swedish quality registries, for example for lung cancer, provide an opportunity to follow the outcome of new treatments. Treatment effectiveness can also be monitored, by using biomarkers, for example. One such example is the TK1 protein, a blood-based biomarker that can provide more information on how an ongoing treatment works for a specific patient, so that the right decisions can be made at the right time.

Immuno-oncology

Several advances have been made in utilising the immune system in new cancer treatments. One of the most promising is the use of CAR-T cells. The immune system's T cells (white blood cells) are reprogrammed to more efficiently identify and destroy tumour cells. The first CAR-T treatment in Europe was performed on a lymphoma patient in Uppsala in 2014. The therapy was approved in Sweden for lymphoma and acute lymphocytic leukemia in 2019. This means that up to 40 percent of patients with a poor prognosis can be cured.



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Radiation Therapy

Four out of ten patients cured of cancer have received radiation therapy as part of their treatment. In fact, it is recommended in more than half of all cancer treatments, often in combination with surgery and medication. Radiation therapy is also important in the palliative treatment of many cancer patients. Despite the investment cost, radiation therapy accounts for only 7 percent of the total budget for cancer treatment.

In an international comparison, Sweden has good access to radiation therapy resources, and has a long and prominent role in the development of modern radiation therapy. This has led to many innovations that have transformed radiation therapy into a central component in the field of precision medicine. As with surgery and medical treatment, radiation therapy is also becoming increasingly targeted and specific, with improved efficacy and fewer side effects.

Sweden's first MR-LINAC, which combines radiation therapy via a linear accelerator with simultaneous diagnostic imaging via an MRI camera, went into operation at Uppsala University Hospital in autumn 2019. It now offers increased precision for patients with certain tumour diseases. The physician can locate tumours and risk organs with higher precision both directly before and during the actual radiation therapy, thereby fine-tuning the radiation therapy plan for further precision of treatment.

“An important advantage of radiation therapy guided by MRI images is that the treatment becomes more individualized and can be focused more precisely on the tumors. This is especially important for tumor sites that are difficult to visualize with non-MRI techniques. The MR-LINAC is also an inspiring project for broad and open collaboration between different medical disciplines and technical professionals with the final goal of improving patient care.”

- Zahra Taheri-Kadkhoda, Head of Radiation Therapy at the University Hospital in Uppsala



Case Study: Gamma Knife Radiosurgery

50 years ago, Professor Lars Leksell at Karolinska invented a gentle way to operate on the brain without a scalpel and without bleeding. Today, Leksell Gamma Knife radiosurgery has become the standard treatment for certain diseases with 90,000 operations each year worldwide. Elekta, founded in 1972 and headquartered in Stockholm, is today a world leader in radiation therapy and precision medicine.

Scan the QR code to read how a young lung cancer patient with 34 brain metastases received Swedish precision medicine and 9 months later is still working and enjoying full quality of life.





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Infection Prevention

Healthcare-Associated Infections (HAI) are infections that affect patients receiving care in a hospital or other care facility, often in connection with medical or surgical procedures. Three of the most common areas for healthcare-associated infections are the urinary tract, bloodstream and respiratory tract. According to the WHO, an average of one in ten patients is affected worldwide. In addition to unnecessary suffering and extended care periods, HAI also lead to high costs and increased use of antibiotics, which accelerates the development of resistance. By preventing infections, millions of lives can be saved every year.

The increasing cancer burden and increased threat of Antimicrobial Resistance (AMR) create a global health issue that must be addressed immediately, as it may undermine the progress made in cancer care. People suffering from cancer are more susceptible to infections due to the weakening of the immune system. Many cancer treatments also use medical devices, which further increases the risk of HAI. As many as one in five cancer patients undergoing treatment must be hospitalised due to infections, and antibiotics are the main treatment.

Sweden is a pioneer in the work against AMR; an issue that has long been a political and clinical priority. A national plan is in place and several global initiatives for cooperation have been taken. We have a relatively good position with regard to resistance, thanks to a national

strategy, a multidisciplinary approach, many prominent researchers in the field and several academic centres in locations such as Uppsala, Gothenburg and Umeå. The Swedish business community also plays an important role in developing and disseminating solutions in areas such as infection diagnostics, drugs, architecture, medical technology and hygiene.

Elements of the solution:

- » Antibiotic stewardship: using antibiotics only when necessary
- » Multidisciplinary approach: ensuring that oncology doctors collaborate with colleagues such as, infection doctors
- » Precision medicine: personalised treatments provide the right treatment for the right diagnosis at the right time
- » New technologies/medtech devices: to prevent infections related to, for example, peripheral intravenous cannulae and catheters
- » Optimising patients' health status before treatment, for example preventing anemia

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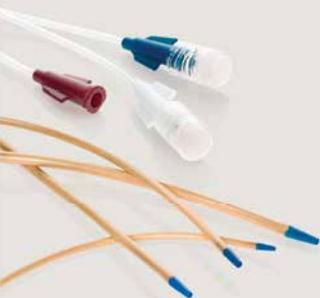
Case Study: HAI Proactive

HAI Proactive is a national innovation and research project with the goal is to develop more effective tools to detect and prevent Healthcare-Associated Infections (HAIs). Read more about HAI Proactive here:



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Survival and Quality of Life

Palliative care is an essential component of cancer care. It is treatment to relieve, rather than cure, symptoms caused by cancer and to improve quality of life for patients and their families.

Survivorship care includes a detailed plan for monitoring potential cancer recurrence, managing long-term effects associated with cancer and/or its treatment, and services to ensure that cancer survivors' needs are met. Precision medicine can reduce unwanted side effects, especially important for childhood cancers, where patients will live for a long time with the impact of their cancer treatment.

Palliative care at end of life

If there is no longer a cure for those who are seriously ill, treatment is focused on making the end of their lives as good and painless as possible, taking into account physical, mental, social and existential needs. Palliative care also includes giving support to relatives.

Patients with incurable cancer often want to remain at home during their last period of life. A palliative care team can offer cancer patients the same safe, advanced medical care in their home as in the hospital, including round-the-clock contact with healthcare staff. The team includes professionals based on the patient's needs, such as doctors, nurses, physiotherapists, counselors and dietitians.

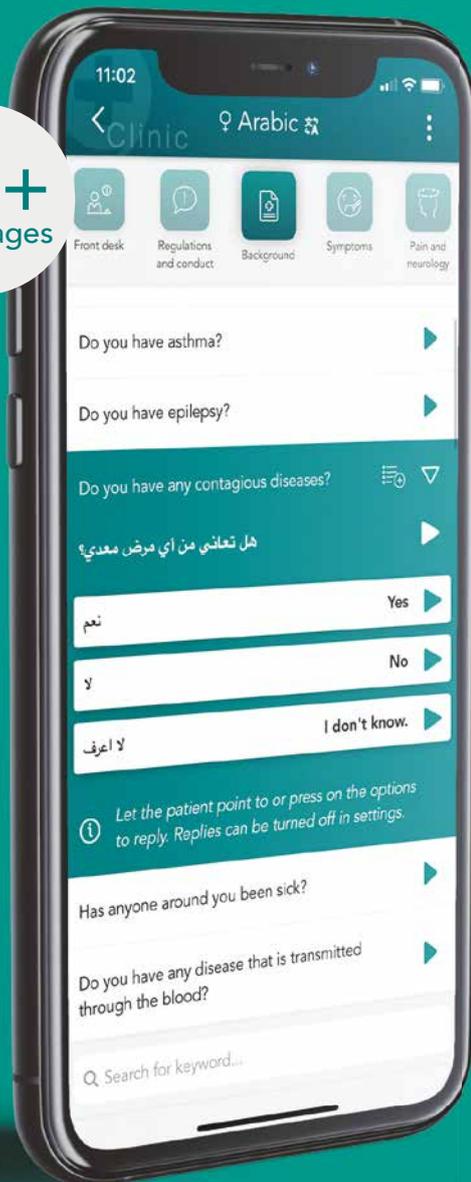
The Swedish Register of Palliative Care is a national quality registry with the aim of improving care at the end of life for patients and close family. Information about care during the last week of life is entered for all deceased. The registry can be used to make follow-ups and improvements where care is provided, and for research.

Childhood Cancer App

Information is of utmost importance for families with children with pediatric cancer. The Childhood Cancer App, used at several Swedish pediatric cancer centres, is an easy-to-use app and provides information such as telephone numbers, useful links, procedures, surveys and a Q&A. It also offers a quick means of communication between healthcare staff and families.

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World-class Research: The Legacy of Alfred Nobel

Sweden is considered one of the world's most prominent research nations, leading the way in a wide range of fields such as oncology, neuroscience and metabolic diseases, as well as genomics, proteomics and diagnostics.

One in five researchers in the country work in the life science sector, and many research projects are born at renowned medical universities such as Karolinska Institute, University of Gothenburg - Sahlgrenska Academy and Uppsala University. Sweden ranks at the very top both when it comes to both innovation and R&D investments per capita.

The Swedish model is built on strong collaboration between academia, government and the private sector, for example through testbeds and innovation departments. Supporting research in life science has been a longstanding priority for the Swedish government, for example through investments in well-developed R&D infrastructure such as SciLife Lab, MAX IV and ESS. Funding agencies and policies help to foster an environment of discovery and co-innovation. The innovation agency Vinnova, important research councils and private foundations and societies such as the Swedish Cancer Society all contribute to funding research and innovation nationwide.

Some examples of cancer research areas in Sweden include:

- » ATMP includes gene, somatic cell therapies, tissue engineering products and combination drugs.
- » Biomarkers for prediction, early detection, treatment and follow-up and monitoring.
- » Radiopharmaceuticals containing radioisotopes designed to attack specific tumors.



CAR-T

Research into CAR-T cells has continued at Uppsala University as well as other Swedish universities since the first treatments in 2014.

"It's very gratifying - this important new drug can now be given clinically to patients suffering relapses of malignant lymphoma who would otherwise have a very poor prognosis. A large proportion can now be cured and require no more treatment," says Gunilla Enblad, Chief Physician and Professor of Oncology at Uppsala University Hospital/Uppsala University.

Despite its high cost, CAR-T cell therapy will explode in the future, Professor Enblad predicts. The next to be registered is CAR-T cell therapy for myeloma. Studies are also underway for malignant melanoma, the brain cancers glioma and glioblastoma, as well as prostate cancer and ovarian cancer.



SAHLGRENKA CANCER CENTER

WORLD-LEADING CARE AND RESEARCH FOR AND WITH THE PATIENT



Sahlgrenska Cancer Center is a centre of excellence for all cancer treatments, gathering researchers, clinicians, patients and other stakeholders. The goal is to provide world-leading care and research for and with the patient.

Our cancer teams redraw the cancer care map, through active participation in national and international expert networks. Together with colleagues around the world, we drive development towards a more equal and accessible cancer care adapted to local conditions.

Sahlgrenska University Hospital offers treatment for children and adults across the cancer spectrum.

The following strategies guide us in providing care in line with the European Code of Cancer Practice ECCP:

PATIENT PARTICIPATION. Each patient must be well acquainted with their care and, based on their needs and experiences, be able to participate in decision-making concerning their own care.

DIAGNOSIS AND TREATMENT. Cancer care is provided by specialized multidisciplinary teams that have access to state-of-the-art equipment and facilities. Our imaging and intervention center with hybrid operating rooms and robotic assistance provides the best conditions for high-quality care. Mobile teams and digital solutions allow patients to stay locally for their care.

TRANSLATIONAL RESEARCH AND INNOVATION. We do research at an early stage and can quickly translate it into new forms of treatment that provide direct patient benefit, through a close collaboration between researchers, clinicians and patients.

INFORMATION AND COMMUNICATION. All data must be open and available to the public.

We have cutting-edge expertise in:

Anal and vulvar cancer

- Chemoradiation therapy for curative purposes
- Surgery for curative purposes

Pancreatic cancer

- Surgery for curative purposes in locally advanced pancreatic and periampullary cancer

Peritoneal cancer

- CRS / HIPEC in disseminated cancer

Bile duct cancer

- Surgery for curative purposes in perihilar biliary tumors

Malignant melanoma

- Isolated limb perfusion (ILP)

Lymphoma and acute lymphocytic leukemia

- Immunotherapy, such as Chimeric Antigen Receptor (CAR)-T cell therapy

Sarcoma

- Advanced diagnosis and treatment of children and adults with skeletal and soft tissue sarcoma in the extremities and trunk wall and abdominal sarcoma

Testicular cancer

- Retroperitoneal lymph node dissection

Various cancers

- Electrochemotherapy/ECT for superficial tumors
- Stem cell transplants

"Expert centers are needed to help cancer patients around the world. If we have the opportunity, we should always try to. It is our duty"

Karin Mellgren, professor of pediatric oncology and Nordic representative in the European Inter-Group for Non Hodgkin Lymphoma (EICNHL).



Sahlgrenska Cancer Center also invests heavily in Advanced Therapeutic Medical Products (ATMP) and Precision medicine, which will transform the care as we know it.

We like collaborations

The hospital has several national assignments that allow patients from all over the country to come to Gothenburg for certain treatments. The center also creates a platform for closer collaboration with other countries, allowing us to contribute with expertise while at the same time learning from others.

If you want to know more about Sahlgrenska Cancer Center, contact Sahlgrenska International Care.

sahlgrenkaic@vgregion.se
+46 (0)31-342 68 00.

Clinical Trials

Clinical studies can give patients early access to new treatments. Many clinical trials in Sweden are now going from “bench to bed”, a measure of innovative power, and thereby helping to save lives. For malignant melanoma, the prognosis has now been reversed thanks to new treatments: 80-85 percent survive, compared with 15-20 percent not too long ago.

Sweden has optimal conditions for clinical trials thanks to:

- » a well-developed healthcare system, with skilled and dedicated staff
- » population registers and social security numbers that make it easy to follow up and retain patients included in a trial
- » a well-functioning government structure with a flexible system for examining applications for clinical trials: application, ethical review and approval
- » access to data via quality registries and the national health data registers
- » a well-functioning biobank infrastructure.

The combination of quality registries and biobanks enables complex combination studies, advanced studies that require access to highly advanced healthcare, and decentralised studies, also known as virtual trials.

Virtual (decentralised) clinical trials

For geographical reasons, almost 70 percent of potential patients cannot participate in clinical trials conducted in hospitals. Many drug studies are being conducted today in small groups with specific diagnoses, which requires participants from all over the country. Therefore, the Medical Products Agency has developed a regulatory model to simplify clinical trials, becoming a pioneer in virtual trials. Digital strategies such as web-based doctor's appointments, electronic consent and patient-reported treatment effects, make it easier for patients to participate in studies, regardless of location.

Clinical trial in oncology at Sahlgrenska

Sahlgrenska Translational Melanoma Group works on translational research for skin cancer, linking university research more directly to clinical research that is closely connected to patient care and treatment. Patients for whom no other treatment has been effective can now try new treatment methods by participating in clinical trials.

“Miracles are happening right now. The new, effective drugs save lives; this is very clear in cancer care. It is important that the Medical Products Agency contributes to continuing this positive development.”

**- Björn Eriksson,
The Medical Products Agency**





“We have a special task to look at different payment models for precision medicine, where the drugs are tested on so few patients that it is difficult to show effect in relation to cost. This is a way to strengthen the conditions for making innovative therapies available to those who need them most.”

- Agneta Karlsson, Director General of the Swedish Dental and Pharmaceutical Benefits Agency (TLV)

Reimbursement for Advanced Cancer Treatments

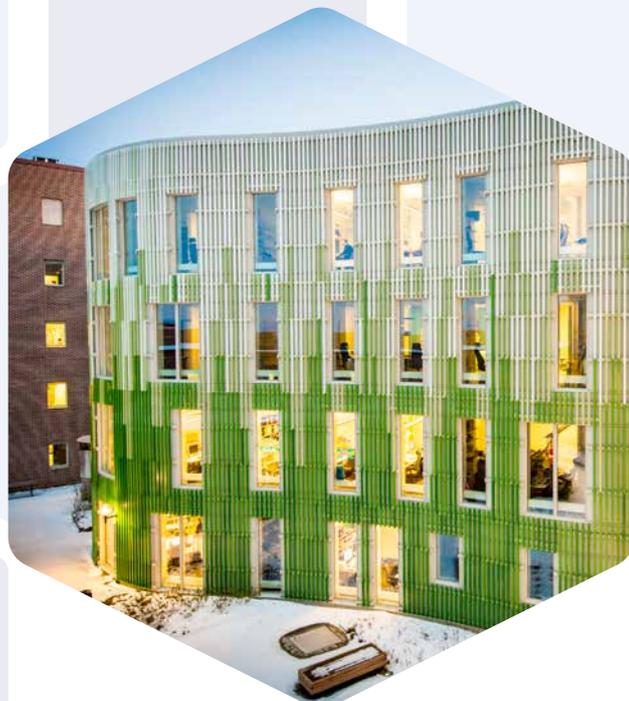
The funding of future healthcare is an important issue, especially in relation to precision medicine and more advanced treatments. The Swedish government subsidises drugs for various reasons, and in particular to ensure universal access to high-quality, effective treatments.

The Dental and Pharmaceutical Benefits Agency (TLV) is a central government agency responsible for getting the largest returns possible for the tax money that the public sector invests in drugs, pharmacies and dentistry.

A recent remit for the agency was to assess different reimbursement and payment models for precision medicine, in order to facilitate the introduction of newly developed drugs, including many cancer drugs. While precision medicine and advanced therapies offer hope of great health benefits for patients, too few patients have so far been able to use it to follow up on

treatment effects. TLV has pioneered a study of how to price such treatments, which shows that results-based models are an alternative. This facilitates healthcare funding over the course of a number of years, and as the patient benefits and efficiency of the treatment become clearer.





Collaboration, the Swedish Way

The Swedish government has stated that Sweden will be a life science leader. “Life science contributes to improving the health and quality of life of the population, ensuring economic prosperity, further developing the country as a leading nation of knowledge and realising Agenda 2030.”

Sweden’s life science sector is home to more than 1,000 companies employing 40,000 people. A large and growing number of life sciences companies are in the start-up phase. Swedish companies excel in drug development, biotech tools, diagnostics, medtech and digital healthcare solutions, and many of them are developing and marketing solutions for cancer care.

The industry works in close collaboration with other actors, such as academia, the healthcare service and patient organisations. Cooperation and dialogue with the healthcare service, including through clinical studies and education, is crucial for developing new effective drugs and innovative medical and digital technology.

The Swedish government has stated that Sweden will be a leading life science nation.

“Life sciences contribute to improving the health and quality of life of the population, ensuring economic prosperity, further developing the country as a leading nation of knowledge and realising Agenda 2030.” The Government’s Life Science Office, led by coordinator Jenni Nordborg, contributes to more effective collaboration and coordination in the implementing Sweden’s national life sciences strategy.

The strategy brings together industry, academia, civil society and public actors to jointly prioritise what needs to be done to meet the healthcare challenges and to further strengthen the important life science sector. The strategy sets 30 prioritised goals, such as investment in data-driven life science, increased focus on health and prevention, integration of research and innovation into care delivery.



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Leading in endocrine tumors

The Uppsala Centre of Excellence is today one of the world leading centers for diagnosis and treatment of neuroendocrine tumors.

Radiation therapy at its best

Our unique MR-linac is setting a new standard for personalized radiation therapy. We also have proton radiation treatments through the Skandion Clinic in Uppsala.

Over one in three people living in Sweden today will be diagnosed with cancer.

Uppsala University Hospital is part of the solution to improve cancer care.

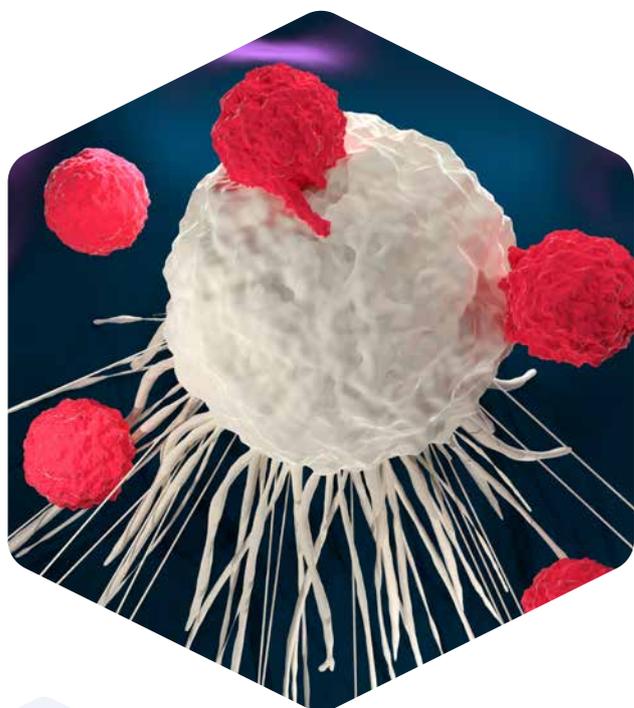
On a general level, cancer survival has increased. Particularly in certain areas, great progress has been made thanks to research.

Uppsala University Hospital is one of the leading university hospitals for cancer treatments in Sweden. We work with centralized and standardized cancer care. Thousands of people receive their professional training every year and we are a world-leading research hospital in collaboration with Uppsala University. Cancer is one of our most important and successful research areas.

For more information about Uppsala University hospital's work with cancer care please visit www.akademiska.se/en/cancercare

Case Study: Vision Zero Cancer

Vision Zero Cancer is an innovation milieu established in 2019, with partners from across different sectors and disciplines. The aim is to jointly create the long-term conditions to achieve the vision of transforming cancer from a deadly to a curable or chronic disease. Vision Zero Cancer is a catalyst for uniting patients, academia, industry and politics around the same vision, and is supported by the Swedish Innovation Agency, Vinnova.



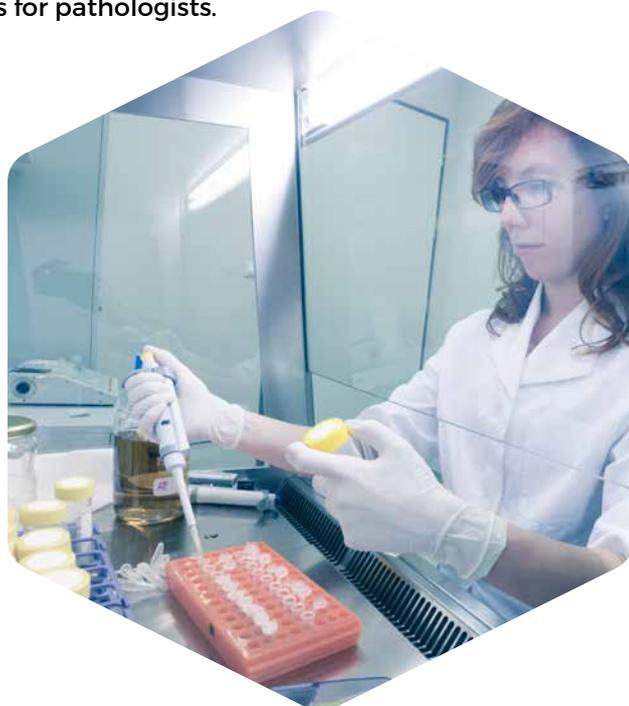
Case Study: Oncological Imaging

“Technological advances, not least in AI, provide fantastic opportunities for better diagnostics and care. However, innovations often get stuck in the gap between the protected workshop of research and the clinical reality. The solution is long-term collaboration to take innovations all the way from concept to patient benefit.”

CMIV, the Centre for Medical Image Science and Visualisation at Linköping University, has worked on the use of image analysis and AI for many years, in collaboration with the private sector, in order to improve oncological imaging, for example by developing new digital methods and tools for pathologists.

Case Study: GoCo Health Innovation City

Just a few years after inauguration, GoCo Health Innovation City is already home to a diverse set of world-class health and life sciences companies, organisations and individuals working to unlock new solutions to global health challenges, including the globally renowned BioVentureHub (azbioventurehub.com). Situated in the heart of the AstraZeneca site, the BioVentureHub is an exciting innovation model for strengthening competitiveness and collaboration in the life sciences industry.





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*The young person shown in this photo is a model and not an actual patient.

The Hospital of the Future



Björn Zoëga, Hospital Director at Karolinska University Hospital in Stockholm.

What does your vision for future cancer care look like, if we talk about the next decade?

“The biggest change is individualised cancer treatment, and it is already used at Karolinska University Hospital. In several areas, we are also at the forefront globally in introducing precision medicine for our cancer patients, and developing more gentle methods through robot-assisted surgery and research in the field of radiotherapy.”

How do we move forward?

“We must continue to invest heavily in diagnostics and to let the data we receive from this control how we organise care around our patients.”

Can you name any specific innovation or research area that you think will contribute to positive development?

“Cancer research at Karolinska has long taken place in collaboration with the pharmaceutical industry and we are now investing further in our Phase-1 units to participate in the early development of new drugs and treatment techniques. In lung cancer care, we are introducing new ways of working to manage complex precision medical diagnostics.”



Mia Rajalin, Patient Representative, Lung Cancer Association

What does your vision for future cancer care look like, if we talk about the next decade?

“That not only treatment is personalised, but also services and contacts. It is a waste of resources to provide the same services and number of contacts to all patients – different people need different things at different times. The patient’s entire situation must be addressed throughout the care process.”

How do we move forward?

“By giving the patient the opportunity to take more responsibility, so that the healthcare service is open to utilising the patient’s own power.”

Can you name any specific innovation or research area that you think could revolutionise cancer care?

“Yes, since cancer often starts with diffuse symptoms, I would like to see scientifically developed digital symptom checkers with the help of AI. If I may wish for another, it would be lung cancer screening through a simple blood test, for those who have never smoked and thus would not be considered for screening with a lung X-ray.”



Larry Leksell, Founder & Chairman, Elekta AB

What does your vision for future cancer care look like, if we talk about the next decade?

“Access to cancer care is extremely unevenly distributed in the world, and for Elekta one of the most important issues is to make sure to bridge the gap that exists between low- and middle-income countries and rich countries and make cancer care, especially radiation therapy, available to more people.”

How do we move forward?

“As I see it, the industry’s responsibility is to contribute to making healthcare affordable. It must maintain the same quality and be equally safe for patients, but become cheaper through, for example, modular solutions, increased automation and the use of AI.”

Can you name any specific innovation or research area that you think could revolutionise cancer care?

“We have recently launched Elekta Unity, a state-of-the-art MR LINAC, which enables increased precision even in radiotherapy of tumors in motile tissue. It is even possible to see the effect of the radiation therapy on the tumor directly at the time of radiation therapy, and thus adjust the dose each time.”

Maria Helling, CEO, Swecare

What does your vision for future cancer care look like, if we talk about the next decade?

“I hope that more people around the world can access preventive measures and early detection, so that as many as possible can be spared from disease and suffering. I also hope that more individualized diagnostics and treatment are available, so that many more can be cured and survive with less side effects.”

How do we move forward?

“The corona pandemic has shown how unevenly distributed health resources effect the whole world. We need to work harder to achieve Agenda 2030 goals related to health.”

Can you name any specific innovation or research area that you think could revolutionise cancer care?

“Apart from the opportunities for personalized diagnostics and treatments offered by combining real-world data and new research, I believe that further developing the support offered to cancer patients and their families will be important for high-quality cancer care.”



Case study: Single room in hospitals

The new buildings of Karolinska University Hospital have been designed to promote a safe patient environment and thus faster recovery. All rooms are single-occupancy with their own bathroom, that help reduce the spread of infection. The clinical environments have strict hygiene requirements, with materials and details chosen that them easy to clean.





Sweden:

- » Population: 10,389,806
- » Degree of urbanization: 87% live in urban areas
- » Life expectancy: average: 82.8
- women: 84.3; men: 80.6
- » Portion of +65: 20%; +80: 5.2%
- » Healthcare proportion of BNP: 10.9%—85% publicly financed and 14% out-of-pocket funding



Swecare

Swecare was founded in 1978 by the Swedish government, the County Councils' Association and the Swedish Trade Council together with representatives of the health and medical care industry, as a semi-governmental non-profit foundation and member organisation. Today, the Ministry of Health and Social Affairs, the Ministry for Foreign Affairs and Sweden's municipalities and regions are still active, and membership has grown to over 100 Swedish companies and organisations.

Business idea

Swecare creates a platform where stakeholders in the Swedish life sciences sector can strengthen their international relations.

Vision

Swecare's vision is a world with good health on equitable terms as well as access to high-quality and sustainable healthcare.

Mission

Swecare seeks to contribute to increased export of Swedish products, services and knowledge within healthcare.

Partners

Swecare works closely with the members and industry organisations for life sciences. Together with the Ministry of Health and Social Affairs, Swecare develops plans and strategies for official export promotion work in the health area. Swecare has a large number of contacts with partners with specialist expertise and carries out its activities together with embassies, consulates, Business Sweden and chambers of commerce around the world.

