



HYKS SYÖPÄTAUTIEN KLINIKKA
HUS KLINIKEN FÖR CANCERSJUKDOMAR
COMPREHENSIVE CANCER CENTRE

HUS COMPREHENSIVE CANCER CENTRE

+ Annual Report 2018

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BOARD OF DIRECTORS AND TOP SCIENTISTS



Johanna Mattson
Director,
Adjunct Professor



Panu Jaakkola
Research Director,
Professor



Mauri Kouri
Administrative Chief Physician,
Adjunct Professor



Vuokko Kolhonen
Chief Nursing Officer



Mikko Tenhunen
Head of Radiotherapy,
Professor



Micaela Hernberg
Head of Solid Tumors,
Adjunct Professor



Ulla Wartiovaara-Kautto
Head of Hematology,
Adjunct Professor



Marjut Leidenius
Head of Breast Surgery,
Professor



Tiina Saarto
Head of Palliative Care Center,
Professor



Sirpa Leppä
Head of Clinical Trial Unit,
Professor



Kimmo Porkka
Professor,
Scientist



Riitta Lassila
Professor,
Chief Physician



Satu Mustjoki
Professor,
Chief Physician



Heikki Joensuu
Professor,
Scientific Advisor



Akseli Hemminki
Professor,
Scientist



Katja Tähkä
Quality Manager

FOREWORD

Johanna Mattson

HIGH-QUALITY AND TIMELY CANCER TREATMENT

HUS's Comprehensive Cancer Centre is the largest and most versatile cancer center in Finland. We were the first in the Nordics and the second in Europe to be designated a Comprehensive Cancer Centre by the Organisation of European Cancer Institutes (OECI).

In accordance with the CCC status, the Cancer Centre offers cancer patients timely, high-quality, multi-professional cancer treatment. New cancer treatments made possible by medical research are a central factor in our operation. Our operation emphasizes a patient-oriented treatment culture. To support this, the Comprehensive Cancer Centre started the first patient advisory board in Finland, and patients can additionally participate in development as experts by experience. As an international pioneer, the Comprehensive Cancer Centre has participated in developing digital mobile services that cover a cancer patient's entire clinical pathway. The services enable patients to report on and monitor their own well-being. Elderly patients have been taken into consideration by starting an outpatient clinic

specializing in geriatric oncology. Needs of young patients are met with developing occupational therapist services to coordinate support measures.

The Comprehensive Cancer Centre is strongly committed to developing care quality and treatment results, and we are currently preparing for Joint Commission International (JCI) and Magnet Hospital (nursing) accreditations. Use of Lean methods, including daily management meetings, is widespread at Comprehensive Cancer Centre.

Cancer treatments are changing towards more personalized therapies, and successful cancer research has a pivotal role in improving treatment results. In 2016, Comprehensive Cancer Centre started an early phase molecular research unit (Phase I), which operates within the Nordic Early Clinical Trial (NECT) network as well. In 2018, researchers at Comprehensive Cancer Centre produced over 250 publications. The number of publications has steadily increased since 2010. HUS has made significant investments in research

infrastructure by setting up a data lake and a biobank to attract even more partnerships with academia and private businesses. With the new Apotti patient information system, the effectiveness of treatments and our treatment results can be assessed in real time.

The Center now uses radiotherapy equipment and methods that are among the most modern in Europe. In 2019, these will be complemented with the first neutron-producing accelerator suitable for patient care. The accelerator will be utilized for boron neutron capture therapy (BNCT). With the BNCT device, the Comprehensive Cancer Centre is in a prime position to develop the new, promising cancer therapy, and acquiring the accelerator to Comprehensive Cancer Centre is a great example of what academic research can yield.

The constantly increasing number of new cancer cases, improving treatments, and migration to larger cities are evident as Comprehensive Cancer Centre treats 5 to 10% more patients every year.

Despite this, the Center has been able to provide quality care without delay while keeping expenditure growth moderate. The Comprehensive Cancer Centre will continue to act as both an international and national leader and develop its operation to meet the growing demand. This goal is shared by all the 120 physicians, 400 nursing professionals, and 50 other cancer treatment experts working at the Center, which guarantees that high-quality expertise is available for the treatment of all types of cancer.

All in all, we have every reason to be satisfied with our development over the past few years. We can confidently look forward to 2022 when the new Bridge Hospital facilities will be finished providing new premises for the Comprehensive Cancer Centre as well. However, much remains to be done especially for the cancers with the worst prognosis. The Comprehensive Cancer Centre has prepared for this work by participating in regional, national, and international networks and investing in innovative corporate partnerships.



Johanna Mattson
Director, Adjunct Professor

1936

Department of Oncology was founded

1939

Finland's first megavoltage machine (with radium, in use from 1939 to 1962)

1954

First use of radioiodine therapy for thyroid cancer in Finland

1955

Finland's first cobalt therapy device

1963

Finland's first accelerators (betatrons), Department of Oncology transferred to Meilahti

1973

First linear accelerator

1976

First use of computer-assisted treatment planning

1981

First autologous stem cell transplantation and first allogeneic stem cell transplantation from a sibling

1988

First use of 3D treatment planning

1991

First allogeneic stem cell transplantation from a registry donor

FOREWORD RESEARCH

Kimmo Porkka

PERSONALIZED CANCER CARE AT THE HUS COMPREHENSIVE CANCER CENTER

In cancer care, we are currently living a time of transformation with novel, effective and relatively well-tolerated anti-cancer drugs being introduced at an increasing pace every year. With the advent of accessible and affordable molecular and functional profiling of each individual patient and tumor we are entering an era of truly personalized treatment for many patients. Besides targeting the malignant cells, we have learned to stimulate host immune responses providing hope for a prolonged tumor rejection and cure. The combination of tumor targeting and anti-tumor immunity restoration will hopefully be the ultimate one-two punch against this deadly disease.

HUS Comprehensive Cancer Center has been in the forefront of these developments both by engaging fruitful collaboration with basic and translational cancer scientists and by setting up an active

early phase clinical drug study center for efficient and rapid translation of research innovations into patient care. Consequently, the number of first-in-man and Phase I-III studies is increasing as is the scientific output of the research talent at the Center, in line with our aim of being one of very top Cancer Centers in Europe.

As outlined in the HUS strategy, we are currently expanding research and development by closely engaging with our major stakeholders - university, pharma, biotech (local SMEs in particular), and patient organizations. The funding resources are being diversified, with focus on larger EU and other major external grants.

Due to ease of access to tumor tissue enabling extensive and repeated sampling, hematological cancers are particularly well characterized at deep genome and transcriptome level. To facilitate effi-

cient drug discovery and repurposing for individual patients, we have complemented molecular profiling by setting up a large-scale ex vivo drug testing platform currently consisting of >500 anticancer compounds. This systems medicine approach developed in collaboration with research groups at FIMM (Institute for molecular medicine Finland) has proven to be highly successful for preclinical drug research (collaborations with several major pharma companies ongoing), predictive biomarker discovery and in novel personalized medicine clinical trials. The systems precision medicine approach has been expanded to include lymphomas and solid tumors using innovative organoid and cancer-on-a-chip technologies.

We are already facing the challenges resulting from the advancement of cancer medicine, treatment complexity and rapidly increasing patient numbers. We need help from clever automation,

AI/deep machine learning algorithms to facilitate treatment/trial matching and advanced home care with intelligent monitoring. HUS has heavily invested in this area with innovative PPP (public-private-partnerships) solutions, such as iCAN (digital-precisioncancermedicine.fi) and CleverHealth ecosystem (cleverhealth.fi).

The near future of cancer care and research looks bright and HUS Comprehensive Cancer Center is well positioned as one of the leading European oncology/hematology centers to provide our patients with the best and up-to-date care possible.



Kimmo Porkka
Professor, Scientist

1995

First docetaxel therapy for breast cancer in the Nordic Countries

1996

First use of stereotactic radiotherapy

1997

Psychosocial unit was launched

1999

Palliative unit was launched

2000

HUS was founded 1.1.2000. World's first imatinib treatment for GIST, and first IMRT treatment in the Nordic Countries.

2001

First photo-pheresis

2003

First image-guided radiotherapy

2004

First use of angiogenesis inhibitor therapy

2006

First quality accreditation of stem cell transplantations in the Nordic Countries

2010

First use of VMAT (volumetric modulated arc therapy)

MAJOR EVENTS 2018

Three new radiation therapy devices

Comprehensive Cancer Centre acquired three new radiation therapy devices with new spacious radiation therapy facilities. The new radiation therapy devices are used to carry out so-called stereotactic radiation therapy, which is used for tumors that require precision, such as small brain tumors and other small tumors of the body. These radiation therapy devices are part of the largest acquisition of radiotherapy equipment in the history of HUS. came available through clinical trials, and the first patient group to be treated is lymphoma patients who have no other effective therapies available.

CAR-T-Cell Therapy

HUS's Comprehensive Cancer Centre introduced for research-use a completely new form of therapy that can even cure patients with recurrent cancer that has proved resistant to common therapies. The treatment is a precision immunotherapy where the patient's own defensive cells (T cells in white blood cells) are modified through gene technology to identify and destroy cancer cells. This is called CAR T-cell therapy. The therapy became available through clinical trials, and the first patient group to be treated is lymphoma patients who have no other effective therapies available.

2011

First use of MRI simulation and first use of breathing controlled radiotherapy Geriatric-oncologic unit was launched.

2012

Adjuvant imatinib study lead by Prof. Joensuu transformed the treatment protocol worldwide

2013

Information on patients' access to care and open trials available online

2014

First cancer center accreditation in the Nordic Countries Rehabilitation unit for cancer patients was launched

2015

Mobile application Noona was launched

2016

Early Phase Trial Unit was launched

2017

Lutetium PSMA therapies began First use of brachytherapy of liver in the Nordic Countries

2018

First use of CART therapy

2019

BNCT device was put into operation

MAJOR EVENTS 2018

Laying the foundation stone of Bridge Hospital

The foundation stone of Bridge Hospital was laid in Helsinki on 26 September 2018 starting the largest construction project in the history of HUS. The Bridge Hospital, which is to be built on the Meilahti Hospital campus, will replace Töölö Hospital and a part of the Department of Oncology. The construction started with demolition and creating substitute premises in early 2018, and the hospital will open in 2023.

National coordination center for allogeneic stem cell transplantation

A national coordination center for allogeneic stem cell transplantation began its operation at the hematology department of Comprehensive Cancer Centre. Referrals from all over Finland are directed to the coordination center, where patients are designated weekly to one of the two centers in Finland that offer allogeneic stem cell transplantation, HUS or Turku University Hospital.

The first national cancer investigator training course

The first national training course for cancer investigators was organized at HUS in 2018. The training qualified participants to act as investigators in clinical drug trials. As part of the course, participants also took the Good Clinical Practice test.

New departments

The radiation therapy department from Päijät-Häme was incorporated into Comprehensive Cancer Centre in early 2018. Päijät-Häme's two linear accelerators carry out external radiation therapy. Radiation therapy planning can utilize a CT scanner, and controlled breathing techniques can be used when implementing therapy. Both Porvoo and Raseborg Hospital breast surgery departments were centralized to the Comprehensive Cancer Center's Breast Surgery Department starting from 2018.

BNCT

HUS and US-based Neutron Therapeutics entered into a contract in 2016 to bring the first ever in-hospital BNCT device to Helsinki. BNCT, which stands for boron neutron capture therapy, is biologically targeted radiation therapy. At the beginning of therapy, the patient receives intravenous boron, which accumulates in the tumor with the help of a delivery vehicle. By radiating the boron-enhanced cancer cells with a neutron shower, a fission reaction occurs releasing large amounts of energy, which destroys the cancer cells. The first target group for the therapy are patients with recurrent head or neck cancer. However, the therapy can be used to treat other tumors as well provided that enough boron collects in the tumor and the tumor's location is suited for BNCT therapy. Building the device itself started at HUS in the summer of 2018, and the first trial therapies will be launched in late 2019 or early 2020.



TREATMENT

Radiation Therapy and
Radioisotope Therapies,
BNCT

Solid Tumors

Hematology and
Coagulation Disorders

Trial Unit

Breast Surgery

Palliative Care Center

Rehabilitation

Medical Imaging

Pediatric Cancers

Nursing

Comprehensive Cancer
Center in 2018

TREATMENT

RADIATION THERAPY

The radiation therapy division is clearly the largest and most versatile radiation therapy ward in Finland.

The Comprehensive Cancer Centre's radiation therapy division carries out external radiation therapy within the Hospital District of Helsinki and Uusimaa and Päijät-Häme Hospital District at the radiation therapy units at Meilahti Hospital and at Päijät-Häme Central Hospital. Internal radiation therapy (brachytherapy) and radionuclide (i.e. isotope) therapies are also carried out in Helsinki. The radiation therapy division is clearly the largest and most versatile radiation therapy ward in Finland. It is the only one in Finland to provide liver brachytherapy, eye brachytherapy in collaboration with the Eye and Ear Hospital, and Lu177-octreotate treatments for NET tumors. HUS Helsinki University Hospital carries out all available radiation therapy treatments centralized to university hospitals, with the excep-

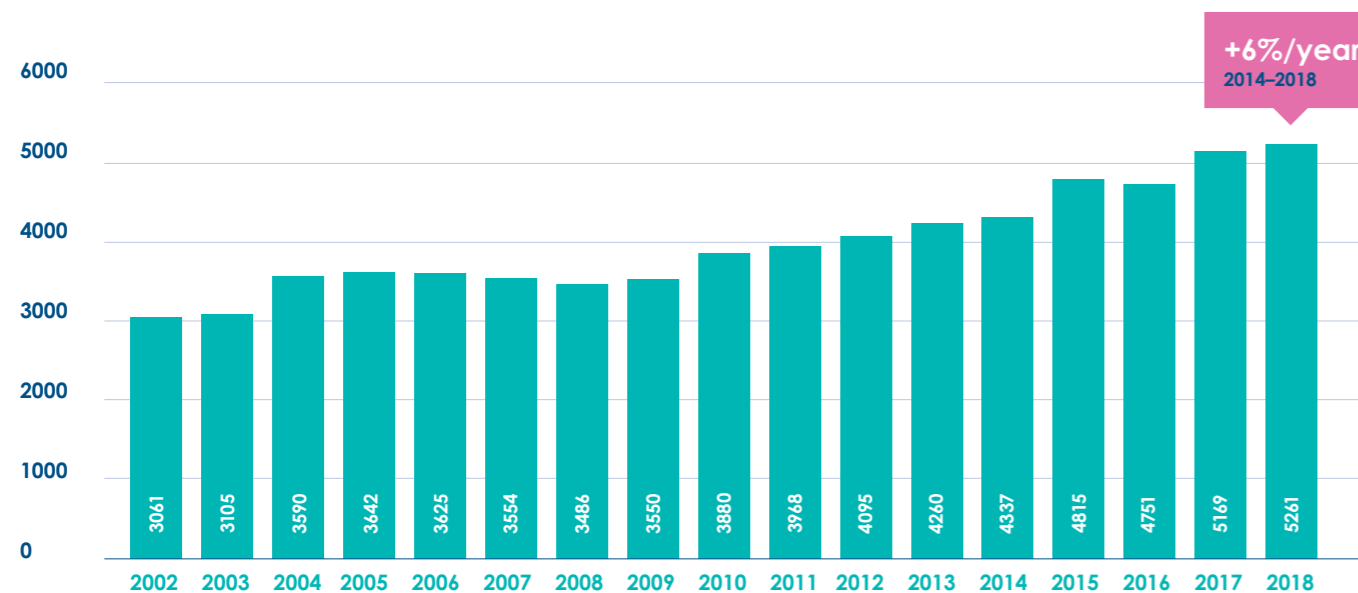
tion of proton therapies, which require patients to be referred abroad. The linear acceleration-based boron neutron capture therapy (BNCT) device, which is globally the first of its kind to be located in a hospital environment, will be taken into use in 2019 and the first research treatments will begin in early 2020 at the latest.

Radiation therapy wards in Helsinki and Lahti

External radiation therapy is provided at the Department of Oncology (10 linear accelerators in 2018, approx. 79,000 treatments) and at the radiation therapy unit at the Päijät-Häme Central Hospital (2 linear accelerators, approx. 11,000 treatments). Radiation therapy is primarily planned based on slice images taken using HUS Helsinki Universi-



Number of radiotherapy patients at Department of Oncology



Average change +3%/year in 2002-2010 and +4.5% in 2010-2014

ty Hospital's computer tomography and magnetic resonance imaging simulators. Approximately 6,000 treatment cycles are administered per year; 5,300 in Helsinki and 700 in Lahti. The majority of these (>90%) take place on an outpatient basis. In 2018, radiation therapy at the center increased by more than 15%, around half of which came from the Päijät-Häme unit (added to HUS at the beginning of 2018) and the other half is represented by an increase in radiation therapy in Helsinki.

In 2018, three new radiation therapy facilities were taken into use. The technology in the new radiation therapy equipment is faster and more precise. It can handle around half as many patients more per day, so the equipment is capable of responding to the increase in

demand while utilizing the latest technology.

Internal radiation therapy

Internal radiation therapy is provided at the Department of Oncology in Helsinki and radiation therapy for eyes is provided in collaboration with the Eye and Ear Hospital. The most common treatment targets for high dose rate technology are the prostate gland, and gynecological cancers. Liver brachytherapy treatment became available in 2017. Around 500 treatments were administered in 2018. In high dose rate treatments, treatment is given using an Ir-192 afterloading device and one treatment takes around ten minutes. In Finland, intraocular radiation therapy is centralized to Helsinki and is a low-dose-rate treatment in-

volving radiation therapy typically lasting around 1 – 4 days. Around 90 procedures were carried out in 2018.

Radionuclide therapies (Isotope therapies)

In Finland, the Comprehensive Cancer Center's isotope therapy unit provides a uniquely extensive range of cancer isotope therapies. In addition to traditional thyroid radioiodine therapies, Ra-223-Xofigo therapy for skeletal metastases, Lu-177-octreotate for NET tumors, Lu-177-PSMA for metastatic prostate cancer, and Y90-SITT therapy for the treatment of hepatic lesions are also available and provided in collaboration with the HUS Medical Imaging radiology team. Around 500 treatments were administered in 2018. The unit has two

TREATMENT

RADIATION THERAPY

The most common procedures carried out at the Radiation therapy division:	Treated/ imaged patients	Number of treatments
External radiation therapy, Helsinki	5261	79081
External radiation therapy, Lahti	730	10864
Dose planning using computerized tomography	5230	-
Dose planning using magnetic resonance imaging	1750	-
Internal radiation therapy	-	622
Radionuclide treatments	-	443

The incidence of cancer is increasing and, as a result, the number of referrals has also steadily increased.

SPECT-CT gamma cameras and a radionuclide laboratory for planning treatments. The majority of isotope therapy is given to patients in radiation isolation during treatment on ward 8 of the Department of Oncology. Some treatments can however be given on an outpatient basis, and this is expected to increase. The radionuclide treatment unit also carries out isotope studies relating to cancer treatment.

Activities

The incidence of cancer is increasing and, as a result, the number of referrals has also steadily increased. Compared to 2017, the number of patients receiving external radiation therapy in 2018 increased by 5.1% in Helsinki and by as much as 16% in Lahti.

The radiation therapy unit at Päijät-Häme and its personnel transferred to activities at the Comprehensive Cancer Centre's radiation therapy division in early 2018 and radiation therapy specialists began work there. As part of treatment staging, patients in the Päijät-Häme hospital district are directed to specialist radiation therapy in Helsinki. In the specific catchment area, an oncologist shortage in Lappeenranta and Kotka has been corrected so that oncologist work has been reduced by one day per week from early 2019 and this work can be carried out remotely as a result of

compatible radiation therapy information systems.

In 2016, HUS Helsinki University Hospital and Neutron Therapeutics entered into a cooperation agreement to build the world's first boron neutron capture therapy (BNCT) device to be located in a hospital and will be used to begin patient treatment and scientific projects. During 2018, the radiation therapy division participated in the design of the construction project and the majority of equipment procurement that fell under the hospital's responsibility was carried out. The BNCT project has progressed slightly behind schedule and the facilities will be released to HUS Helsinki University Hospital in April 2019. After this time, testing will continue and the first patients are expected to be treated as part of a research protocol in 2019. Renovation work on the old Department of Oncology will continue and part of the Radiation Therapy Ward's office and appointment facilities will have to be moved out of the way to the third floor of the clinic building.



SOLID TUMOR DIVISION

The Comprehensive Cancer Centre's solid tumor division is responsible for providing outpatient medication to adult cancer patients, ward care and, for some cancers, follow-up care after primary treatment. There is a consulting physician at the solid tumor division who provides oncological consultations for external colleagues over the phone during office hours. Outside office hours, questions are answered by the on-call physician.

Activities have increased during 2018, and this is reflected in a rise in the number of new referrals as well as in a rise in the number of visits and systemic treatment provided. Activities have also been made more diverse. Since early 2018, the solid tumors division has sold oncological services to oncology outpatient clinics in Päijät-Häme, where drug treatments and follow-ups are provided to cancer patients. Meetings are held regularly with the leadership of all specific catchment areas, twice per year. Personnel from hospitals in specific catchment areas can participate remote-

ly in the Comprehensive Cancer Centre's educational meetings.

The Comprehensive Cancer Centre has again been able to respond to a rise in the number of referrals in 2018 and the center treated 8.1% more patients than in the previous year. In 2018, the median treatment periods for the largest disease groups remained good and close to the national recommendations, although the number of personnel at the center has increased at a significantly slower rate than the number of patients.

The majority of systemic treatment is provided at outpatient clinics and the number of chemotherapy doses has increased by 8.9% in one year.

The Comprehensive Cancer Centre has introduced new anticancer drugs in accordance with HUS Helsinki University Hospital guidance based on assessments by the HUS Clinical Group, Fimea or Palko. Finland's first CAR T-cell therapies for lymphoma patients were conducted at the Comprehensive Cancer Centre within the framework of scientific research and preparations for the intro-

duction of treatment outside of research have begun at the Comprehensive Cancer Centre.

In spring 2018, the Day Hospital carried out a Lean development project relating to the urgent treatment of patients with metastatic bowel cancer. In the fall, a Lean development project was carried out on ward 8 to provide smoother access to treatment and activities for emergency patients. Both Lean projects were very successful and the smoothness and efficacy of activities were increased.

In 2018, ward 7 was named one of HUS Helsinki University Hospital's best units for excellence in wellbeing at work.

Day Hospital

Activities at the Comprehensive Cancer Centre's Day Hospital include appointments with doctors, specially trained nurses and specialist employees, as well as anticancer systemic treatment administered at the Day Hospital. Approximately 40 doctors and 90 nurses work at the unit, which provides a total of 96 beds. Individualized systemic treatment

Major tumor groups	All appointments	First visits
Breast cancer	18 183	844
Bowel and rectal cancer	6 015	473
Lymphomas	5 876	230
Prostate cancer	3 912	110
Lung cancer	2 876	81

is planned for patients and implemented to a high-quality by a multi-professional care team specializing in the relevant cancer.

For cancer patients, the deployment of the digital Noona applications has been extended to the Day Hospital. It is used at appointments and to monitor adverse treatment effects. In late 2018, some of the doctors' appointments were replaced with a digital letter appointment if the patient reported that their condition had remained good during a new type of drug treatment.

The geriatric oncology outpatient clinic serves patients over the age of 80 as part of its appointment activities. The increase in elderly patients is addressed by transferring the geriatric oncology outpatient clinic's activities to the Day Hospital, where elderly patients are provided with treatment advice and any oncological treatments are planned by oncologists specializing in geriatric care.

There is also an outpatient clinic at the Day Hospital that provides long-term follow-up for young adults who suffered from cancer as children. In addition to other psychosocial support, occupational therapy services are now also available to young patients receiving treatment.

Wards

Approximately 3000 patients are treated on the Comprehensive Cancer Centre's two wards each year. A total of eight doctors, 50 nurses and three secretaries work at the Comprehensive Cancer Centre. Both wards provide long chemotherapy treatments requiring overnight stays. In addition, the wards focus on treating patients with severe cancer symptoms or problematic adverse effects caused by anticancer drugs. Ward 7 primarily deals with chemotherapy treatments for lymphomas and testicular cancers. Autologous stem cell transplantation activity has also risen, and in 2018, 31 autologous stem cell transplantations were carried out there. Ward 8 primarily deals with isotope treatments such as radioiodine and lutetium treatments. The number of lutetium therapies is clearly on the rise, and in 2018, approximately 380 radioisotope therapies were carried out on ward 8.

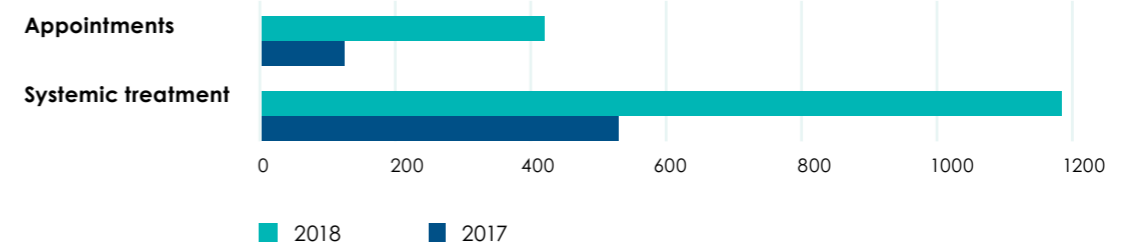
Outlook for the future

The Comprehensive Cancer Centre's activities will remain busy as the total number of cancer patients continues to grow as a result of an ageing population and new treatment options. The aim is to

respond to the increasing number of patients by e.g. making the division of work between personnel groups more effective, and utilizing digitalization by using Noona applications customized for cancer patients, for example. The center will strive to increase the number of digital remote consultations and appointments. This is estimated to result in treatments that are better targeted to those who will benefit from them and a reduction in treatment complications. The division of work between doctors and nursing personnel is being piloted in accordance with the "back office" model on ward 4 of the Bridge Hospital's Day Hospital, which treats breast cancer patients. In the future, we will seek to make it possible for an increasing number of specialists to undertake one or two days per week of part-time work at the Clinical Trial Unit in order to diversify their jobs. We can also contribute to the conditions necessary to increase scientific work at the center by creating joint posts.



Noona users



HEMATOLOGY DIVISION

The largest hematology unit in Finland

The clinic is the largest hematology unit in Finland and plays a key national role in e.g. stem cell transplantations, the treatment of rare, hereditary blood diseases, early-phase drug development and translational research. Operations are supported by the Finnish Hematology Register and the first biobank in Finland to focus on a single group of diseases (FHRB). The research carried out by the hematology department focuses on molecularly targeted pharmacotherapy, the genetics of hematology, immunotherapy, and coagulation disorders. Patients are treated at the outpatient clinics for hematology and rare hematological diseases, at the coagulation disorder and stem

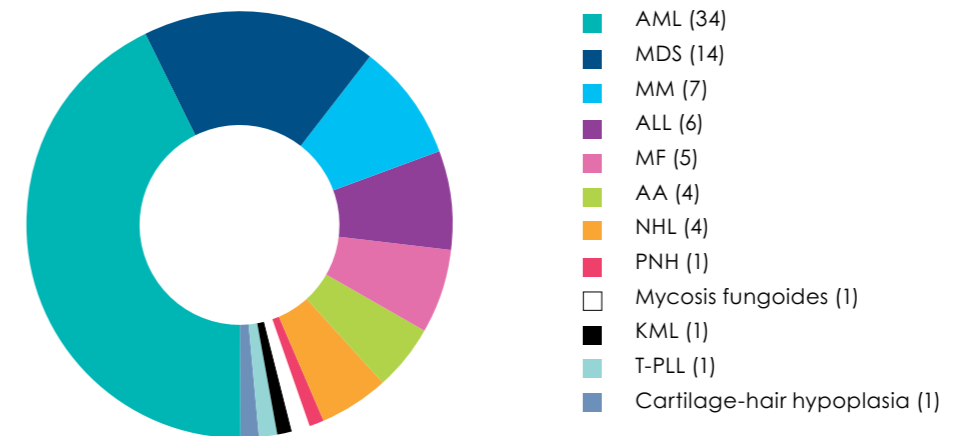
cell transplantation units, and on the hematology wards (7A and B).

Appointment-only outpatient clinics, day hospital operations and the hematology wards

Appointment-only outpatient clinics operate at Meilahti Triangle Hospital and Peijas Hospital, providing university hospital-level diagnostics and outpatient treatments. A large number of treatments for blood diseases can be administered at home or at the day hospital. The Meilahti Triangle Hospital has two hematology wards, one of which is for patients who are acutely ill with blood diseases, while the other is for autologous



Indications for allogeneic stem cell transplantation in 2018



and allogeneic stem cell transplantations. There are a total of 32 beds on the wards. Hematology patients are also treated on the internal medicine ward at Peijas Hospital (7 beds).

Outpatient clinic for rare blood diseases

A family-centered joint outpatient clinic for rare hematological diseases in adults and children was established in 2018. It provides centralized treatment for hemoglobin abnormalities, hereditary cell deficiencies and syndromes that cause a predisposition to blood cancers. The outpatient clinic provides a consultation service and specialist treatment for approximately 250 patients each year. Services are also provided to patients outside HUS. The outpatient clinic received official status as a rare disease center in 2018.

HUS Coagulation Disorder Unit

The Coagulation Disorder Unit at HUS is the only unit in Finland that focuses on the treatment of patients with hemorrhagic and occlusion disorders. It provides nationally centralized treatment for some of the most challenging cases

of hemophilia and offers a wide range of multi-disciplinary care for patients with hemorrhagic diseases. It also provides consultation services for other medical specializations.

Stem cell transplantation unit

The stem cell transplantation unit at HUS is the largest in Finland and the coordination of all allogeneic stem cell transplantations is nationally centralized to the unit. In 2018, 79 allogeneic stem cell transplantations and 41 autologous stem cell transplantations were carried out. The majority of allogeneic stem cell transplantations are donated by registered HLA-compatible donors. Haploidentical transplantations from first-degree relatives make up a growing group. The majority of patients treated with allogeneic stem cell transplantation suffer from acute myeloid leukemia (Figure 1) and multiple myeloma, treated with autologous transplantation.

In addition to autologous and allogeneic transplants, the first CAR T-cell therapy at HUS was given to oncological research patients at the stem cell transplantation unit.

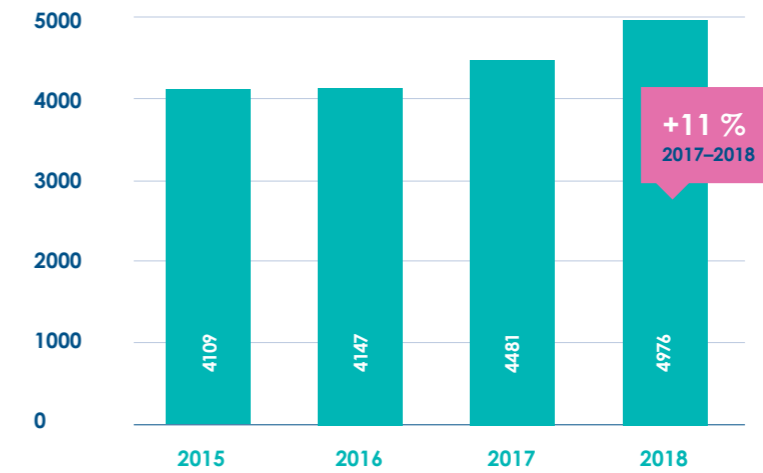
Activities

The incidence of blood diseases is increasing and as a result, the number of referrals has also steadily increased. Compared to 2017, the number of referrals increased by 20% (2,169 referrals in 2018) and the number of patients treated rose by 11% (4,976 patients in 2018), (Figure 2). 1,195 new patients were treated in 2018, which was 3% higher than in the previous year. The number of outpatient contacts rose by 17% compared to the previous year. An increasing number of contacts were treated as remote contacts. The total number of appointments with doctors increased by 3% on the previous year, and the number of remote contacts was 17%. Blood diseases are largely diagnosed at specialist medical and university-level treatment units, such as the hematology clinic. Patients are usually referred quickly for diagnostic tests: within 1-21 days depending on the suspected blood disease. For some patients, treatment begins as soon as their diagnosis is confirmed, while others are treated later on, depending on the nature of the blood disease.

There were 11,762 treatment days in 2018. 12% of these took place on the in-



Number of hematology patients treated at HUS Helsinki University Hospital



ternal medicine ward at Peijas Hospital, while the rest occurred on two different wards at the Meilahti Triangle Hospital. Ward treatment days rose by 4% compared to the previous year. In recent years, efforts have been made to shorten the on-ward treatment period for hematology patients and to enable home care. The average treatment time on the stem cell transplantation ward was 19 days, while it was 8 days on a regular hematology ward. The most significant product groups are allogeneic stem cell trans-

plantations (obtained from healthy stem cell donors), the treatment of acute leukemias, and the treatment of other blood cancers. 74 allogeneic stem cell transplantations were carried out in 2014, 94 were carried out in 2015, 79 were carried out in 2016, 71 were carried out in 2017, and 79 were carried out in 2018. 73% of the transplants were taken from registered donors, 18% were donated by siblings, and 9% were haploidentical transplantations. In accordance with treatment staging, the active treatment of

HUS area patients suffering from acute leukemias is centralized to the Meilahti Hospital, which is why these patient groups make up some of the largest patient groups in Meilahti's outpatient clinics and on its wards. The most common chronic hematological diseases, such as myeloma, chronic lymphocytic leukemia and myeloproliferative diseases are highlighted at the Peijas outpatient clinic and on its wards, and at the Meilahti outpatient clinic.

The largest patient groups	Patients treated	Ward treatment days	Outpatient clinic contacts
Myeloproliferative diseases	771	316	3444
Multiple myeloma	513	1521	7602
Coagulation disorders	487	59	931
Acute leukemias	307	5063	5779
Chronic lymphocytic leukemia	272	175	1781
Chronic myeloid leukemia	176	107	631
Myelodysplastic syndromes	154	882	2088

TREATMENT

CLINICAL TRIAL UNIT

17
New clinical trials

(A) significant number of clinical drug trials carried out at HUS Helsinki University Hospital are conducted at the Comprehensive Cancer Centre's Clinical Trial Unit. Activities have been increasing since 2010. In 2018, 17 new internationally competitive clinical drug trials were initiated at the unit, including Finland's first CART study. In 2018, the unit was also the first in the world to carry out first-in-human trials on three drugs. A total of 97 clinical drug trials were open, of which 72 related to oncology and 25 related to hematology. 39 clinical drug trials were active, 58 were in the follow-up phase, and 16 were investigator-initiated. 125 patients were recruited for trials. The unit administers around 100 clinical drug trial treatments each month.

The early-phase molecular trial unit (Phase I Center) operates as part of the Clinical Trial Unit. The establishment of the Phase I Center in 2016 has increased the number of early-phase clinical drug trials in the specializations of oncology and hematology. The center is active in the Nordic Early Clinical Trial (NECT) network (<https://nordicnect.org>).

Personnel at the unit include a unit manager, 3 coordinators, 14 research nurses, 2 infusion nurses, a secretary, 5 doctors and several part-time research doctors. In 2018, a full-time chief physician in early-phase oncological trials and 3 new research nurses began work at the unit.

In the fall of 2017, we organized a cancer research nurse course in the HUS Helsinki University Hospital Specific Catchment Area which was completed by 22 research nurses. In the spring of 2018, we organized a national clinical cancer investigator course, which was completed by 25 clinical researchers.

Some of our main partners include the Clinical Research Institute HUCH, HUSLAB, HUS Pharmacy, HUS Medical Imaging Center, the University of Helsinki, Helsinki Biobank and the Institute for Molecular Medicine Finland.

The aim is to

- provide opportunities for an increasing number of patients to be among the first to receive new, safer and more effective trial treatments
- ensure a high quality of clinical drug trial activities in all areas
- be a competitive excellence unit by networking ever more closely with international clinical drug trial groups and basic research

Contact persons

Oncology:

Sirpa Leppä,
Professor, Head Physician

Katriina Peltola,
Docent, Chief Physician

Marita Repo,
Nurse Manager

Susanna Miettinen,
Research nurse responsible for day-to-day activities

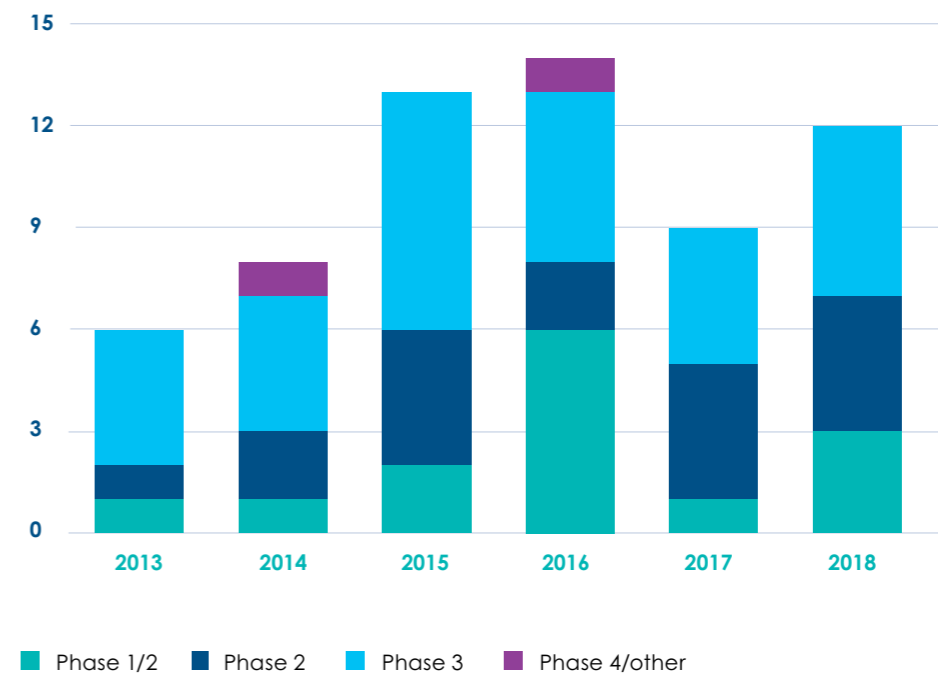
Hematology:

Kimmo Porkka,
Professor, Head Physician

Saara Vaalas,
Research Coordinator



Number of new oncological trials



In 2018, 17 new internationally competitive clinical drug trials were initiated at the unit, including Finland's first CART study.

TREATMENT

THE LARGEST BREAST SURGERY UNIT IN THE NORDIC COUNTRIES

Proven effective treatment

- Approximately 1,500 breast cancer operations each year
- Excellent treatment outcomes and expertise
- 11 specialists in the surgical treatment of breast cancer, 3 breast cancer nurses and 26 nursing staff
- Internationally respected research work

The Breast Surgery Unit performs almost 1,500 breast cancer operations each year. It also performs surgery to rule out or diagnose breast cancer. The Breast Surgery Unit also treats and operates on benign tumors and infections in the breasts. Women diagnosed with a gene mutation that increases the risk of breast cancer are also treated at the Breast Surgery Unit.

The Breast Surgery Unit carries out high-quality scientific research to develop therapies, and the results have been published widely in medical journals and at international cancer conferences.

Surgery at Porvoo and Tammissaari was centralized to the Breast Surgery

Unit at the start of 2018. In 2018, a total of 1,480 breast cancer patients underwent surgery. Of these, 1,427 were new cases of breast cancer, while 53 cases involved the recurrence of breast cancer. Over 70% of the operations were breast-conserving.

The Breast Surgery Unit's treatment outcomes have proven excellent. In a five-year follow-up period, the risk of breast cancer recurrence in the breast or armpit area in operated patients is just 2–3%. The five-year survival rate was 98% in patients with a tumor size of less than 2cm. Approximately 90% of patients treated are satisfied or very satisfied with the treatment they have received.



TREATMENT

PALLIATIVE CARE

1 in 3
Finns will get
cancer

Better quality of life and symptom control

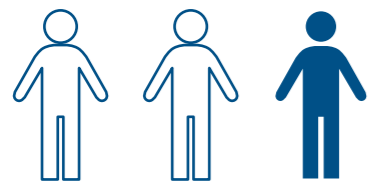
The HUS Palliative Care Center is responsible for palliative care, education and scientific research throughout the entire hospital district. Palliative care seeks to alleviate patients' physical, psychosocial and spiritual suffering, to improve the quality of life for the patients and their loved ones, and to maintain patients' functional capacity. The center's extensive competence and high-quality care, provided in some of the most difficult circumstances, have their foundation in the professionalism of personnel and in cooperation with other units. The doctors at the center are palliative care specialists with backgrounds in various medical specializations. The care team also includes social workers, physiotherapists, a clinical dietitian, psychiatrist, psychologists, a psychotherapist and a chaplain.

Around 2,000 comprehensive care plans for palliative or hospice care are drawn up with patients and their families each year. The need for symptom relief and psychosocial support, the support measures required by patients in home care, the patient's wishes and expecta-

tions, and family members' coping ability and support needs are assessed at an appointment. In addition, the center also assists in the provision of home help and end-of-life care for those who need it.

A networked consultation clinic

- Coordinates HUS Helsinki University Hospital's palliative care and hospice care network in cooperation with the Cancer Society of Finland's hospice, with home hospitals, palliative care units and hospices in primary health care.
- A consulting outpatient clinic that serves roughly 2,000 patients each year. A consulting doctor and nurse also visit other clinics to provide consultation.
- A multi-professional and multidisciplinary center, the center employs specialist physicians from various medical specializations with special competence in palliative medicine.



The Comprehensive Cancer Centre treats approximately 30,000 patients each year and one in ten require special psychosocial support.



SUPPORT WITH CHANGE

Cancer drastically changes a person's day-to-day life, including how they cope at home, their ability to work, finances and relationships. At the Comprehensive Cancer Centre, patients and their relatives have the opportunity to talk with expert professionals and receive guidance and advice.

Finland's only psychiatrist-led psychosocial support unit operates at the Comprehensive Cancer Centre and has been at HUS Helsinki University Hospital for more than 20 years. The unit's task is to talk with patients who require special support to help them cope with the new and difficult circumstances arising from cancer. Patients and their relatives can discuss their situation with a social worker, who provides personalized advice and guidance on many of the problems and questions that can arise from the change in situation. A hospital chaplain visits the clinic regularly and is available to meet with patients and their families if they wish.

Since 2017, the Comprehensive Cancer Centre has operated an occupational therapy service

for young adults suffering with cancer. The occupational therapist primarily works with young people aged between 18 and 35. The service aims to retain the best possible level of functional capacity, as well as to strengthen the young person's independence in everyday life and to participate in making their own life choices.

A unique psychosocial unit

- Approximately 600 patients per year
- 3-4 visits per patient on average
- At least one in ten cancer patients require special psychosocial support

TREATMENT

REHABILITATION AND MEDICAL IMAGING



PHYSIOTHERAPY AND NUTRITIONAL CARE HELP TO IMPROVE PATIENTS' PHYSICAL CONDITION

Appropriate nutrition and maintaining the patient's mobility and functional capacity are important factors during cancer treatments. The physiotherapists and clinical dietitians working at the HUS Comprehensive Cancer Centre guide and counsel patients in order to achieve the best possible treatment outcomes.

Physiotherapy promotes the patient's mobility and functional capacity using therapeutic exercise and manual therapy. The physiotherapist also individually evaluates the need for medical devices, such as supportive sleeves after breast cancer surgery, mobility aids, and other devices that support day-to-day activities, and provides guidance

and advice on how to purchase and use the devices. Dietitians assess the patient's level of nutrition and draw up nutrition plans if necessary.

Rehabilitation

- promotes patients' mobility and functional capacity
- provides preconditions for successful treatment
- evaluates the patient's needs for medical devices and provides advice on how to use them
- promotes recovery after cancer treatments

MEDICAL IMAGING AS THE BACKBONE OF TREATMENT

HUS Medical Imaging Center is the largest provider of medical imaging examinations in Finland. It is responsible for the diagnostic examinations of patients at the Comprehensive Cancer Centre.

The Comprehensive Cancer Centre's radiography unit employs seven radiologists and 12 radiographers. The radiologists work closely with the physicians who are treating the patients. Patient cases are reviewed by various specialists at daily meetings.

Patients at the Comprehensive Cancer Centre are also examined at other HUS Medical Imaging Center radiography units in the Meilahti campus area.

Patients are examined using

- ultrasound (e.g. of the breasts and stomach area, contrast-medium examinations of the liver, ultrasound-guided sampling)
- computed tomography
- magnetic resonance imaging
- mammography (breast cancer screening)
- PET-CT scan



CUTTING-EDGE CANCER CARE FOR PEDIATRIC PATIENTS

New Children's Hospital offers pediatric cancer treatment on one campus:

- Dedicated and research-oriented pediatric cancer center with excellent clinical results.
- Treats the most common pediatric malign diseases, including leukemia and lymphoma, with excellent results typical of top-level international centers.
- Accredited national unit for pediatric allogeneic organ transplants.

One in three Finnish children with cancer is treated at HUS, at New Children Hospital's wards concentrating on oncology, hematology and stem cells. We always aim to offer patient-driven and family-friendly care. The hospital is involved in several Nordic and European treatment protocols.

The survival prognosis for pediatric cancer patients in Finland is among the best in Europe: over 80% of children are cured. The prognosis for leukemia, the most common malignant disease in children, has improved enormously during the past decades.

HUS's results in the treatment of most common pediatric cancer, ALL, are among the best in the world: 97% of chil-

dren are cured. The excellent results are due to goal-oriented research and close, international co-operation in treatment protocols.

Brain tumors are the second most common pediatric cancer, and lymphomas are in third place. In Finland, the prognosis for cure in brain tumors is 75.6%, and 91.2% in lymphomas. Both are at a high level in international comparison.

Over 85% are cured
The survival prognosis for
pediatric cancer patients in
Finland is among the best in
Europe.



TREATMENT

NURSING

Nursing at the Comprehensive Cancer Centre is carried out in accordance with HUS's strategy, which focuses on good leadership, well-functioning structures, high-quality professional practice and the utilization of new knowledge in patient care as outlined in the Magnet Hospital model. Nurses participate development through expert groups operating at different levels within the organization. Multidisciplinary care work is carried out in a variety of operating environments: on oncology, hematology and breast surgery wards, and in an outpatient environment, such as at the oncology outpatient clinic, the breast surgery outpatient clinic, the radiation therapy ward, the day ward, and at the Palliative Care Center.

Models for carrying out nursing include a primary nursing system on he-

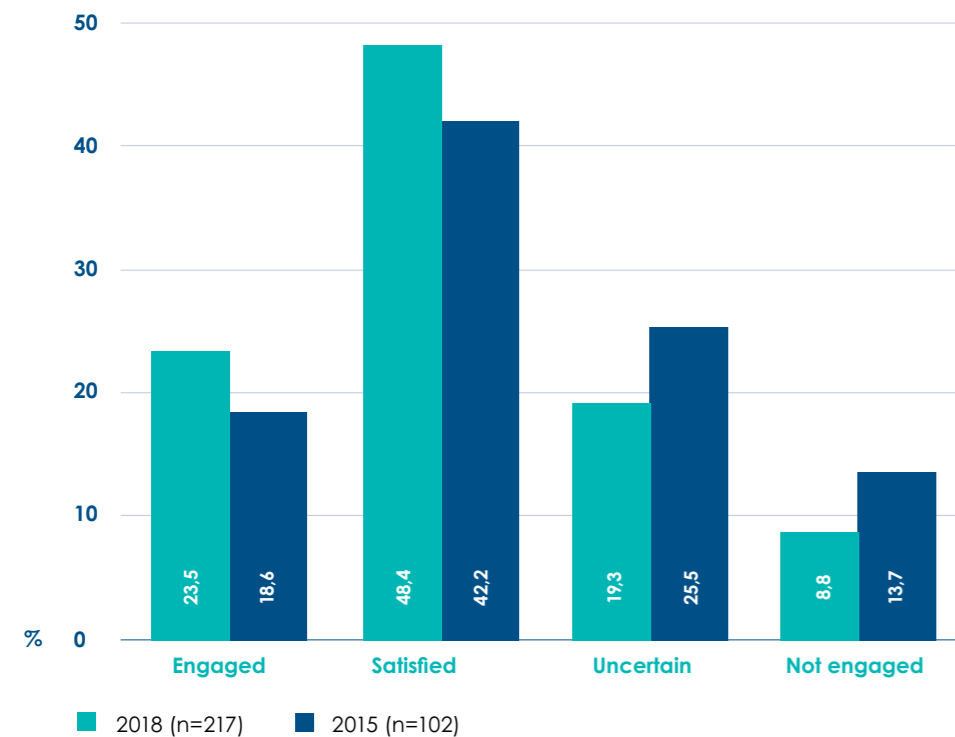
matology and day wards, teamwork on the radiation therapy ward, and an independent nurse practice at the oncology outpatient clinic and Palliative Care Center. As a resource, care is allocated appropriately using patient classification and a daily resource allocation model.

Patient-centered care is supported by means of a patient advisory board (from 2016) and experts by experience (from 2018). The activities are coordinated by persons with a background in nursing. Feedback on patients' satisfaction with care is collected continuously. The introduction of health technology has provided new methods for care, e.g. the use of mobile applications in remote monitoring, and the use of medication guidance videos to provide patient guidance.

Nursing at the Comprehensive Cancer Centre has been developed within the

framework of the Magnet Hospital model since 2014. The production of care indicators and the comparison of results in an international database has continued in 2018. In the comparison, we monitor the incidence of ≥ stage-2 pressure ulcers and patient injuries due to falls per 1,000 treatment days, as well as the incidence of cannula and catheter-associated infections per 1,000 cannula or catheter days. The systematic screening of cancer patients for the risk of malnutrition has continued. Patient feedback on care work is collected quarterly. Nurses' engagement with their work is assessed twice per year using the Nurse Engagement Survey (NES).

Degree of engagement in 2015 and 2018, all respondents



Engagement was measured using the following statements:

1. I would recommend this organization to my friends as an excellent workplace
2. My organization inspires me to perform with excellence
3. I will most likely be working in this organization in three years' time
4. I am ready to invest in and work hard for the success of my organization

4,8
Average grade
in feedback
statements on a
scale of 1 to 5



PATIENT FEEDBACK ON CARE 2018 (N = 1205)

Patient feedback on care consists of 23 questions. The feedback has been extremely good. On a scale of 0-5, statements scored an average of 4.8 (range 4.66-4.97) at a departmental level.

FUTURE TARGETS

The aim is to achieve higher than average Magnet Hospital Model indicator scores in national and international comparisons. Another indicator target is to achieve the targets set out for key objectives in HUS's strategy.

INDICATOR RESULTS 2018

CHART 1

Pressure ulcer prevalence on wards on the 3rd Thursday of each month, number of ≥ stage-2 pressure ulcers /1000 treatment days (key target incidence < 1.9%):

Q1/2018	2 pressure ulcers originating elsewhere
Q2/2018	5 pressure ulcers originating elsewhere
Q3/2018	no pressure ulcers
Q4/2018	4 pressure ulcers originating elsewhere
total	0

CHART 2

Number of falls that have caused patient injury, at a departmental level (key target number <0.8 / 1000 treatment days):

Q1/2018	20 on wards
Q2/2018	28 on wards
Q3/2018	12 on wards and 1 at an outpatient clinic
Q4/2018	20 on wards and 1 at an outpatient clinic
total	82
Number of falls on wards 3.6 / 1000 treatment days	

CHART 3

Central venous cannula-associated sepsis on wards:

Q1/2018	7
Q2/2018	9
Q3/2018	3
Q4/2018	5
total	24

TAULUKKO 4

Urinary catheter-associated infections on wards:

Q1/2018	0
Q2/2018	2
Q3/2018	1
Q4/2018	0
total	3

TAULUKKO 5

Malnutrition risk screening (key target ≥ 80%)

Hematology wards 7A and 7B	91 %
Oncology wards 7 and 8	95 %
Breast surgery ward	47 %
Outpatient clinics and day wards	22 %
Radiotherapy ward	2 %

COMPREHENSIVE CANCER CENTER IN 2018

Population in HUS district
1 654 333

Population in HUS's Specific Catchment Area (includes HUS)
2 164 311

Number of patients treated at the HUS CCC
30 144

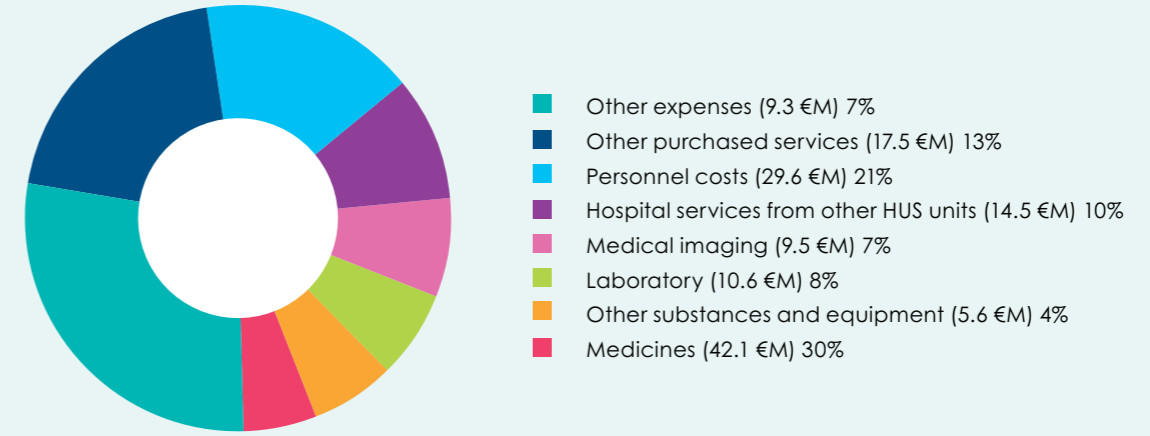
Number of new patients treated at the HUS CCC
11 507

Inpatient periods
5 534

Outpatient service products
249 706

Referrals
14 133

Operating expenses and depreciations in 2018 (1000 €) 138.7 €M



Number of beds
95

Number of outpatient chairs
96

Number of chemotherapy treatments
63 500

Number of radiotherapy fractions
90 000



Quality and Patient Safety

Patient Involvement

Patient Services

QUALITY AND PATIENT INVOLVEMENT

QUALITY AND PATIENT SAFETY

The principal goal of the Comprehensive Cancer Centre is to guarantee patients high quality and effective treatment without delay. Operations are founded on national legislation, on the strategy of HUS and of the Comprehensive Cancer Centre, on the objectives defined for the operations and on systematic monitoring, evaluation and development. The guideline for operations is the Quality and Patient Safety Plan adopted by the HUS Executive Board on 15 April 2019.

Establishing culture of quality and patient safety is important and requires the assuming of shared responsibility and an active and multidisciplinary approach on various levels of the organization. Various quality control systems (OECI, JACIE, JCI, Magnetic Hospital, etc.) and tools (lean, etc.), and internal and external audits, are used for evaluating and further developing our operations, along with adverse event reports (Haipro), patient feedback, patient complaints and patient objections. Successfully establishing a culture of patient safety requires the entire personnel to take part actively in the evaluation and development of our operations.

Adverse events 2018

In 2018, just over 1,000 adverse event reports were recorded (HaiPro), of which 9 were serious adverse events. The largest number of adverse events was reported for drug and fluid therapy (34%), followed by communications and information management (32%). Some 37% of the adverse events were hazards that were either anticipated or corrected before any actual damage could occur. Of the adverse events affecting patients (n=632), 3% (n=30) caused moderate harm to a patient, and 0.4% (n=4) caused serious harm to a patient.

Adverse event reports (HaiPro) are processed by quality and patient safety

coordinator pairs. The Comprehensive Cancer Centre has a guideline for handling adverse events. Serious adverse events are discussed at the serious adverse event debriefing chaired by the Quality Manager, using root cause analysis. Measures to be taken are agreed on, an implementation plan is drawn up, a coordinator is appointed and execution of the measures is monitored.

The Comprehensive Cancer Centre has a patient safety working group that meets four times a year. The working group discusses all adverse events that are in risk categories III to V or have caused moderate or serious harm, monitors the execution and effectiveness of the resulting development measures and submits development proposals to the quality and patient safety steering group of the HUS Joint Authority Administration for discussion.

The units of the Centre have designated quality and patient safety coordinators responsible for the development, evaluation and monitoring of quality and patient safety in their respective units. Units prepare an interim annual report on adverse event reports three times a year.

Lean and Kaizen as development tools

In 2018, three Comprehensive Cancer Center employees underwent Lean training involving development actions in their units. The topic was the monitoring of melanoma patients using a mobile app, improving first appointments for radiotherapy patients, and streamlining first pre-op visits to the anesthesiology clinic for breast cancer patients.

In all, seven Comprehensive Cancer Centre employees have undergone Lean training.

In 2018, inpatient ward 8 and day ward 5 of the Comprehensive Cancer



Centre participated in the Kaizen week for applying to Lean activities at HUS. The aim for inpatient ward 8 was that emergency patients would be admitted to the ward within four hours of arrival. The project involved creating an electronic ward waiting list for emergency patients, staggering arrival times for elective patients, preparing further treatment plans for patients on the day prior to discharge, and discharging patients between 09.00 and 10.00. Over a six month monitoring period, 90% of emergency patients were admitted to the ward in less than four hours. The aim for day ward 5 was to improve access to treatment for patients with metastasized bowel cancer. In the course of the project, staff duties were clarified, duplication was reduced and the duties, booking templates and room arrangements for drug therapy were changed. The result of the Kaizen

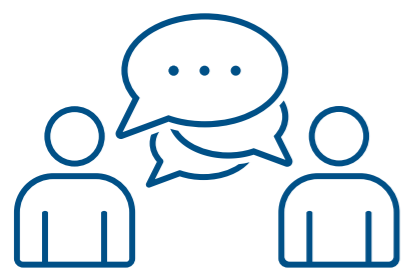
project was that patients were treated in four treatment rooms instead of six as before, appointment times were distributed more evenly and the time taken by nurses for registration was reduced by 30% to 50%.

Daily Management board as an operations management tool

The purpose of Daily Management is to steer and improve operations and to ensure that every employee is familiar with the goals for the day and their duties and that any potential problems are identified. One of the major goals of Daily Management is to solve within the unit as many issues as possible. The units of the Comprehensive Cancer Center each have a Daily Management board on the wall. Each unit has determined and selected indicators reflecting their respective characteristics so that they measure their

goals, quality and safety and serve as an aid for improving operations. The management of the Comprehensive Cancer Center participates in Daily Management meetings regularly.

A new functionary, the Clinic Senior Pharmacist, began work at the Comprehensive Cancer Centre at the beginning of 2018. The job involves promoting a culture and process of drug safety; distributing drug information; training, advising and inducting personnel; monitoring and analyzing drug therapy deviations and adverse effects; and identifying drug therapy risks. The Clinic Senior Pharmacist is also required to conduct medication safety checks on wards or on individual patients if medication problems are suspected. With the appointment of the Clinic Senior Pharmacist, the safety and quality of drug therapy particularly for patients receiving oncological drugs orally have improved.



Establishing culture of quality and patient safety is important and requires the assuming of shared responsibility and an active and multidisciplinary approach on various levels of the organization.

QUALITY AND PATIENT INVOLVEMENT

QUALITY AND PATIENT SAFETY

Comprehensive Cancer Centre focus areas and how they were addressed in 2018

Focus area	Measures	Outcomes
Promoting a culture of patient safety and increasing the number of improvement measures based on adverse event reports	<ul style="list-style-type: none"> Involving personnel in the processing of adverse event reports and in problem solving Entering improvement measures in the HaiPro system 	<ul style="list-style-type: none"> Adverse events reports have led to 22 improvement measures
Piloting patient safety walks for managers and supervisors	<ul style="list-style-type: none"> Cancer Centre participated in the pilot project Patient safety walk conducted on four wards 	<ul style="list-style-type: none"> Patient safety walks adopted as HUS practice
Correct and sufficient use of hand sanitizer to be boosted through training and monitoring of consumption	<ul style="list-style-type: none"> Hygiene coordinators in units trained to monitor hand hygiene Consumption targets per unit to be calculated 	<ul style="list-style-type: none"> Hygiene coordinators in units have begun to monitor hand hygiene Consumption targets per unit have been calculated, and units are monitoring consumption
Improving medication safety <ul style="list-style-type: none"> Developing the drug therapy process Identifying risk drugs at the Cancer Centre 	<ul style="list-style-type: none"> Preparing a risk drug list for the Comprehensive Cancer Centre Drug therapy plan to be included in induction training Ward drug therapy plans to be updated to be consistent with ward operations 	<ul style="list-style-type: none"> A risk drug list for the Cancer Centre and a guideline concerning the adverse effects of oncological drug therapy for adult patients have been prepared On wards, drug cabinets have been reorganized by therapy group The Clinic Senior Pharmacist has given briefings in units on the HUS Pharmacy general guidelines The Clinic Senior Pharmacist is actively involved in the updating of units' drug therapy plans

Quality assessment

In 2014, the Comprehensive Cancer Centre became the first university hospital in the Nordic countries and the second one in Europe to receive the highest status awarded by the Organisation of European Cancer Institutes (OECI): Comprehensive Cancer Centre, or CCC.

To achieve CCC status, a hospital must have a high level of quality in treatment, a patient-oriented care culture and cutting edge scientific research and training. The accreditation process involved improving operations in a variety of ways so as to comply with the criteria. Opera-

tional and scientific strategies were prepared for the Comprehensive Cancer Centre. In a pioneering project, monitoring of patient treatment access times was begun, and the data are published as a guarantee of minimizing delays. Treatments for each individual patient are decided at multi-professional care meetings that are held frequently, and the tumor groups update their disease-specific treatment recommendations in real time.

In 2018, the Comprehensive Cancer Centre focused on preparing for the OECI CCC reaccreditation, which will be conducted in 2019. The Comprehensive Can-

cer Centre is also participating in the peer review of treatment paths for early-phase breast cancer and prostate cancer in the OECI network. The Comprehensive Cancer Centre has continued to engage in national peer review of operations with other university hospitals. In a new departure, peer review among hospitals within our own specific catchment area was launched. The Comprehensive Cancer Centre has begun preparation of the HAKE and ERN CAN applications for the Southern Finland Regional Cancer Center in the context of the latter's operations. Development of care work in accordance

The Helsinki University Hospital Cancer Centre received the status of Comprehensive Cancer Centre in 2014

with the Magnet Hospital Model was continued in 2018, including preparation for the Joint Commission International (JCI) evaluation.

The purpose of the OECI network is to improve and harmonize oncological treatments, to share good practices among hospitals and to foster the integration of scientific research into care processes.

In spring 2018, the HUS launched a Joint Commission International (JCI) accreditation project, where the Comprehensive Cancer Centre is involved, enhancing its quality and patient safety efforts in its sector. JCI originated in the USA and is now the most widespread hospital accreditation system in the world. JCI is a comprehensive quality system, covering all aspects of hospital operation: patient care, administration, personnel training and evaluation of qualifications and competence. Facilities and their safety are also evaluated.

Patient feedback, complaints and objections

Patient objections, injuries and complaints are important forms of feedback

that are used for planning and further development of operations. The information gained from patient feedback is used for instance in reporting according to the adopted patient safety plan.

Objections are processed as specified in the Chief Medical Officer's guideline; the respondent at the Cancer Center is the Administrative Chief Physician or the Chief Physician of the Hematology Division.

The Patient Ombudsman prepares a report on customer feedback for each division three times a year. Objections, complaints and patient injury reports are processed at the relevant operating unit, either at a departmental meeting or in a one-on-one discussion with a supervisor as part of the unit's quality control process. If the feedback concerns operations or processes at the unit, the information received will be used for improving the operations of that unit.

In 2018, the Comprehensive Cancer Centre received 19 patient injury reports, of which two resulted in compensation being paid.



PATIENT INVOLVEMENT

A direct quote from a patient's feedback:

"I received fast and professional care, and I was notified of changes in time."

"Scheduling was carried out flexibly and with consideration for the patient, for which I would like to say thank you. The treatment was brisk and pleasant, and my visit was hassle-free."

Customer satisfaction

Customer satisfaction is measured through continuous customer feedback that patients can submit electronically or on a paper form. Feedback on care is collected four times a year. Customer feedback was submitted just over 2,000 times in 2018, and over 95% of it was positive. 99% of respondents would recommend the Comprehensive Cancer Centre as a health care facility. Customer feedback is evaluated three times a year and resulted in the following being identified as areas for development at the Comprehensive Cancer Centre in 2018:

- patients are provided with sufficient and understandable information
- consideration for privacy protection
- inspection of signage for the new entrance
- good patient interaction experience

Patient Advisory Board

HUS Helsinki University Hospital's first panel to consist of patients has operated

at the Comprehensive Cancer Centre since 2016. In accordance with HUS's Joint Authority Administration's 2018 guidance, and in collaboration with Laurea, a two-day patient advisory board training event was organized to train the 12 patients sitting on the panel for the Comprehensive Cancer Centre. The task of the patient advisory board is to assist, brainstorm and support the planning, development and assessment of the Comprehensive Cancer Centre's services and activities. The patient advisory board aims for the opinions, evaluations, experiences, perspectives and ideas of patients and their relatives to be considered in an organized and increasingly comprehensive manner when planning the Comprehensive Cancer Centre's activities and services. The customer panel helps to make activities at the Comprehensive Cancer Centre more patient-centered. The patient advisory board meets once a month.



Patient advisory board activities in 2018

Visits to units and observations	Participation in events	Promoting patient-centered care	Ensuring that patients and their relatives are heard
<ul style="list-style-type: none"> • Presentation of the patient advisory board's activities and familiarization with units' activities • Observation visits to units. Observation targets are selected by members of the patient advisory board. • Observation of signage for the new entrance 	<ul style="list-style-type: none"> • HUS Helsinki University Hospital patient rights day • Women's Day at the Comprehensive Cancer Centre • Men's Day at the Comprehensive Cancer Centre 	<ul style="list-style-type: none"> • Commenting on patient guidance and patient videos • Collaboration with OLKA to organize peer support activities for two wards and for ward 5 at the Day Hospital • Evaluation of customer feedback and presentation of suggested solutions • Commenting on the "Customer service with care" presentation • Work on the Comprehensive Cancer Centre's patient support presentation 	<ul style="list-style-type: none"> • Work at the Bridge Hospital's model facilities to plan the ward's patient room and sanitary facilities • Participation in the workshop pilot as part of the Ministry of Social Affairs and Health's service promise • Commenting on the Comprehensive Cancer Centre's website



Experts by experience:

The Comprehensive Cancer Centre's first 12 experts by experience completed their training in May 2018. Training to become an expert by experience lasted for five months, including seven themed on-site training days. An expert by experience's own experience of cancer, treatments and living with the disease provides tools for the development of services and activities. The aim of expert by experience activities is to make experts by experience equal partners to profes-

sional personnel in the development of services at the Comprehensive Cancer Centre. Shared expertise; that is, collaboration between professional personnel and experts by experience, produces a well-functioning and patient-centered culture of care, which results in an even better care experience for the patient and their relatives.

Units can order experts by experience for e.g. various activity development projects and training events.

PATIENT SERVICES

Noona is used at the Comprehensive Cancer Centre:

- with breast cancer patients throughout the entire care pathway from surgery to follow up monitoring,
- with patients with urologic cancers,
- with bowel cancer patients,
- with melanoma patients,
- with lymphoma patients,
- with patients receiving immunotherapy, and
- with Clinical Trial Unit patients.

Doctors, nurses and patients at the Comprehensive Cancer Center participated in the development of the Noona service.

Digital services

A Cancer House and Palliative Care House have been added to the Health Village, and they provide lots of information for patients. You can log in to HUS Helsinki University Hospital's care pathway for breast cancer patients via the Health Village. The patient will receive an appointment letter containing an invitation to the care program, which they must log in to. The Health Village care program provides the patient with detailed information about each treatment phase, along with patient instructions. The care program works alongside the Noona mobile application, providing the patient and their relatives with information.

A customer service bot, or chatbot, has been developed to answer the most frequently asked questions for new patients at the Department of Oncology. The chatbot is a computer program that is designed to engage in conversation. Chatbots work by using key words to identify the topic of a conversation. The customer service bot can be found in the Health Village's Cancer House.

The Comprehensive Cancer Centre also has its own website. The website publishes information such as patient treatment access times. In 2013 it became the first Finnish cancer hospital to begin to measure treatment access times. Treat-

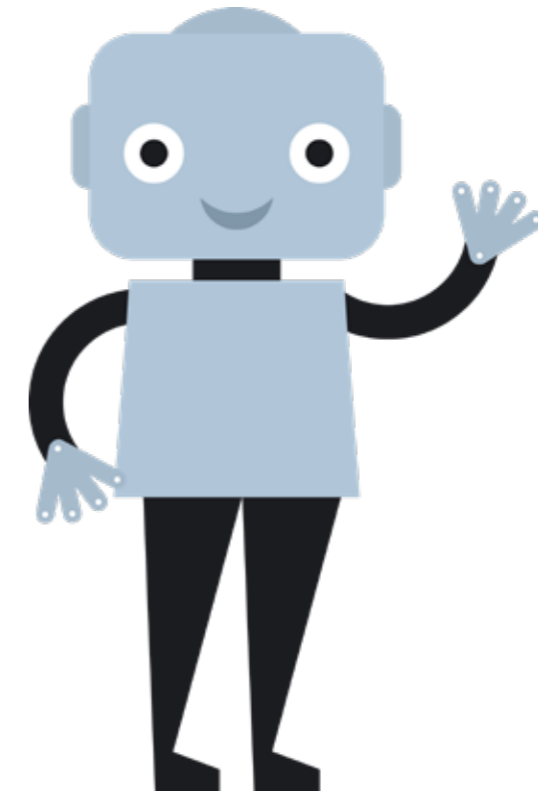
ment access times are published on the website to ensure no delays. The website also publishes trials that are open to patients, and digital care pathways and patient instructions for major diseases.

The Noona mobile service

Noona is a mobile service that allows the patient to communicate with the care team at the HUS Comprehensive Cancer Centre during treatment and the follow-up phase. Symptom surveys, and other general treatment-related information where necessary, are sent via Noona before treatment. Patient responses to the symptom survey and other information sent via Noona are reviewed daily. The patient's care team will send a response and treatment instructions via Noona within 1 – 2 business days. In some situations, Noona will identify a set of symptoms and send an automatic response, which will be checked by the care team later on.

Advisory services and peer support

An OLKA® advice point and an advisor for the Cancer Society of Southern Finland both operate at the Department of Oncology. OLKA® refers to coordinated organization and volunteering activity in the hospital. Activities aim to offer patients and their loved ones unhurried en-



Chatbot answers the most frequently asked questions for new patients at the Department of Oncology.

Finland's first patient advisory board was established at the Comprehensive Cancer Centre.

counters and support in coming to terms with their disease. OLKA® also provides peer support and information about various patient organizations. Information, support and advice about cancer is available from the advice service nurse at the Cancer Society of Southern Finland. The service is free for patients and their relatives. There are electronic information boards in the waiting areas that provide information on news relating to activities at the Comprehensive Cancer Centre and HUS Helsinki University Hospital. The Comprehensive Cancer Centre organizes group information for e.g. breast cancer patients before they move on to the follow-up phase.

Patient involvement in service development

Finland's first patient advisory board was established at the Comprehensive Cancer Centre. Patients can also participate in the development of activities as experts by experience. The Comprehensive Cancer Centre has pioneered the development of tailored digital Noona mobile services for self-reporting and follow-up that cover the entire care pathway for cancer patients.



RESEARCH

[Research in Comprehensive Cancer Centre](#)

[Research Groups](#)

[Key Projects and Funding](#)

CANCER RESEARCH AT THE HUS COMPREHENSIVE CANCER CENTRE

There has been a monumental improvement in cancer survivorship in the past 50 years. Cancer survival has more than doubled during this time in the developed countries. The main reason for this has been the investment in cancer research since the declaration of “war on cancer” in early 70’s. Research has improved survival at multiple levels, ranging from early detection and diagnostics to surgery and from radiation therapy to design of novel drugs based on molecular biology. The latter has given us examples of drugs that can cure such advanced diseases that 20 years ago inevitably led to death.

However, cancer is still the second leading cause of death globally with immense human suffering but also large economic impact. Noticeably, there is a huge variation in survival between different cancer types. The 5-year survival in testicular or thyroid cancer is far over 90% while less than 5% of patients e.g. with pancreatic cancer survive that long. Therefore, the need for cancer research has not disappeared but in fact increased as finding effective treatment for several cancers has become more complicated and work-intensive.

HUS Comprehensive Cancer Center is strongly committed to improve cancer treatment by supporting cancer research at multiple levels. We perform and advance clinical and translational cancer research on a wide scale. We conduct clinical trials ranging from first-in-human and other early phase trials in our clinical trial unit to larger phase III trials. The trials include novel cancer medicines, radiation therapy and surgical trials as well as palliative and psychosocial care. Clinical trials are important for several reasons. They benefit cancer patients who get more treatment opportunities as well as the clinicians who get early experience on novel treatments.

Trials sponsored by the pharmaceutical industry are important to us and our patients, but particular interest is also given to enhancing academic research, both clinical trials and translational laboratory research as well as nursing science. A number of our cancer center scientists and research groups direct research in laboratories dedicated to cancer care. Examples of cutting-edge research employed at our center include individualized systems medicine and technologies such as Car-T cell therapies as well as globally unique novel accelerator-based boron neutron capture therapy (BNCT) studies. Moreover, cancer diagnostics and treatment produce a large amount of clinical data. These are increasingly exploited in our research using artificial intelligence in several research projects in collaboration with Aalto University researchers.

Our research is evaluated regularly by a scientific advisory board (Professors Brian Huntly, Cambridge, UK; Roger Henriksson, Sweden; Patrick Schöffski, Leuven, Belgium and Pasi Jänne, Harvard, USA) since 2015 with the last meeting in fall 2018. While the advisory board found the science to be of high quality, it also noted that the number of trials could even be higher with increased level of external support, particularly relating to personnel.

Panu Jaakkola
Research director



Cancer Research at HUS Comprehensive Cancer Center

- 7 professors
- 25 principal investigators
- 5 translational laboratory groups
- Approx. 20 senior investigators and 50 doctoral students
- Funding of over 8 million euros in 2018
- 2 doctoral theses underway in nursing science
- A scientific advisory board consisting of international experts evaluates our research regularly.

Hundreds of scientific studies

- An average of 40 new studies are launched every year.
- In 2018, we had 180 ongoing studies
- Comprehensive Cancer Center produces over 250 scientific publications annually.
- Nearly 20% of these are published in high-impact (IF>10) international journals.

RESEARCH GROUPS: FROM CLINICAL TO TRANSLATIONAL RESEARCH

An introduction to the Comprehensive Cancer Centre's research groups

The individualized treatment of leukemia

Professor Kimmo Porkka's group (@kporkka)

www.helsinki.fi/hematology

The group aims to develop the multidimensional characterization of leukemia (genome, transcriptome, functional studies, image analysis), automatic diagnostics and treatment selection based on machine learning, and guidance on how to enable the

individualized treatment of acute leukemia. The group also carries out related preclinical (biomarkers, recycling) and early-stage pharmaceutical research. The group consists of three senior researchers, two doctoral candidates, and students.



Oncolytic immunotherapy for the treatment of cancer

Professor Akseli Hemminki's group

<https://www.helsinki.fi/en/researchgroups/cancer-gene-therapy-group>

The research group develops oncolytic viruses that can be used to change the immunological environment of tumors so that an increasing number of patients with solid tumors can benefit from the antibody-mediated modulation of immune responses and other T-cell-based treatments (e.g. CART, TIL and TCR). The group consists of two senior researchers and five doctoral candidates.



Lymphoma group

Professor Sirpa Leppä's group

www.helsinki.fi/en/researchgroups/lymphoma-biology-and-survival

The group aims to improve the treatment outcomes for lymphomas. The group conducts academic and pharmaceutical industry-sponsored clinical drug trials in which the treatment of lymphoma is individually tailored to the patient based on the risk of recurrence and biological properties. The group also examines clinical and biological factors that determine patients' response and prognosis at Biomedicum's applied tumor genomics research program laboratory. In addition to the group leader, the group consists of five senior researchers, seven doctoral candidates, research nurses and bioanalysts.



The pathogenesis of blood cancers and autoimmune diseases

Professor Satu Mustjoki's group (@HRU_research)

www.helsinki.fi/hematology

The group studies the pathobiology of malignant blood disorders (such as leukemia) and autoimmune diseases, as well as the immunobiology of tu-

mors with the aim of finding molecular targets for new and curative treatments. The group combines basic research with clinical drug trials.

The group consists of seven senior researchers, 11 doctoral candidates, and students.

RESEARCH

RESEARCH GROUPS

The efficacy of antibodies in breast cancer

Professor Heikki Joensuu's group

In extensive clinical trials, the group examines the efficacy of antibodies that target the Her-2 receptor in adjuvant treatment for breast cancer. The group also conducts cellular bi-

ological research into the mechanism of action of medicines that target the HER-2 receptor. The group includes senior researchers and a doctoral candidate.



Quality of life and rehabilitation

Professor Tiina Saarto's group

Research focuses on the quality of life and rehabilitation of patients with cancer and other chronic diseases at various stages of their illness, including at the end-of-life stage. The group al-

so examines the impact of art, physical rehabilitation and palliative care on patients' quality of life and wellbeing. There are seven doctoral students in the group.



Melanoma research group

Adjunct Professor Micaela Hernberg's group

The research group focuses on factors affecting the efficacy and safety of different melanoma therapies, develops treatments tailored to the needs of the individual patient, and assesses the

treatment of melanoma in specific groups. The group consists of two senior researchers and five doctoral students.



Coagulation disorders research group

Professor Riitta Lassila

The group's objective is translational research, i.e. transferring basic research findings to clinical applications. Research focuses on new methods of testing blood coagulation and a wide-ranging comparison of these methods in current and clinical routine methods to promote the early diagnosis of coagulation diseases and monitoring of new therapies to ensure patient safety. In particular, platelet function tests

and the antithrombotic effects of heparin proteoglycan are leading to a phase 1 clinical trial through preclinical work. As part of the new Oncosys research group (RPU), the group focuses on ovarian, testicular and pancreatic cancers' effects on coagulation and platelets. The group comprises three senior researchers, three doctoral candidates, and students who are in the advanced phase of their studies.



Electronic reporting tools for cancer

Adjunct Professor Johanna Mattson's and Adjunct Professor Carl Blomqvist's group

The group examines the impact of electronic patient reporting tools on patient preference, satisfaction and compliance, quality of life, symptoms, treatment outcomes, cost of treatment, and the tools' potential in the development of cost-effective processes in cancer care. The group consists of four senior researchers and two doctoral candidates.



Boron neutron capture therapy

Adjunct Professor Mikko Tenhunen, Adjunct Professor Leila Vaalavirta, Professor Heikki Joensuu

Boron neutron capture therapy (BNCT) is a new kind of biologically targeted form of radiation therapy to treat cancer. It can be administered in a single treatment and to areas which have previously received maximum radiotherapy, sparing healthy tissue (page X). In 2019, a new kind of BNCT neutron accelerator installed at HUS Helsinki University Hospital was the first of its kind in the world to be installed at a hospital. In its first phase, the study focuses on the efficacy and safety of BNCT in the treatment of advanced cancers for which there are no other treatment options. The BNCT study also collaborates with groups from the University of Helsinki to develop new boron carriers and to begin wider research into the cellular biological effects of BNCT.



GIST group

Professor Heikki Joensuu's and Panu Jaakkola's group

Biomedicum's GIST laboratory is investigating the biology of the rare gastrointestinal stromal tumor cancer and medicines' mechanisms of action. The group also examines the effect of tyrosine kinase inhibitors and radiation therapy on the prevention of GIST progression in extensive clinical trials. The group consists of three senior researchers and a doctoral candidate.



Breast surgery research groups

Professor Marjut Leidenius's and Adjunct Professor Tuomo Meretoja's group

The groups assess treatment practices and surgical procedures in the recurrence of breast cancer and in patient survival. Four doctoral students participate in the research groups.



RESEARCH

RESEARCH GROUPS

Renal cancer research group

**Professor Panu Jaakkola's and
Adjunct Professor Katriina Peltola's group**

The group examines clinical and biological factors that affect the progression of renal cancer and treatment efficacy, particularly with regard to immune response modulation therapies. The group consists of two senior researchers and a doctoral student.



Soft tissue and bone sarcoma group

Adjunct Professor Carl Blomqvist

Collaboration between the HUSLAB Laboratory of Cytomolecular Genetics and Pathology, the Department of Oncology, Plastic Surgery clinic and Orthopedics clinic began in 1987 to systematically recover tumor samples in connection with tumor surgery. The research team has produced more than ten doctoral theses and almost 200 high-quality articles on subjects such as chromosome changes and molecu-

lar genetic mutations in sarcomas, changes in DNA copy number, the clinical significance of changes in copy number and microchip analyses, and the development of methods suitable for the examination and treatment of sarcomas. The group consists of ten senior researchers and six doctoral students.

FinnGen research project

**Adjunct Professor Tuomo Meretoja and
Professor Heikki Joensuu**

FinnGen is an extensive, nationwide biobank study which aims to produce genetic information from 500,000 Finnish biobank sample donors. Cancer is one of the FinnGen project's priorities, and researchers from the HUS Comprehensive Cancer Centre, as well as a significant number of its patients, are taking part in the study.



Rare subtypes of breast cancer and the development of treatment

**Adjunct Professor Johanna Mattson's and
Adjunct Professor Carl Blomqvist's group**

The study focuses on breast cancer in men and very young women. The group also characterizes rare subtypes of breast cancer, such as metaplastic and neuroendocrine breast cancer, in collaboration with Docent Heli Nevanlinna's laboratory. The Women's Hospital is collaborating with clinical geneticists to investigate genetic predisposition to breast cancer. Collaboration is also carried out with Juha Klefström's laboratory to take experimental treatments based on breast cancer models to early-stage clinical trials. The group comprises several senior researchers and three doctoral students.



The role of hereditary factors in blood cancers

**Adjunct Professor Ulla Wartiovaara-Kautto's and
Adjunct Professor Outi Kilovaara's group**

The group examines the genetic mutations occurring in the germline of blood cancer patients, their frequency and the interaction of somatic mutations and the blood cell's growth environment. Research focuses on investigating early biological mutations that lead to blood cancers, and to find forms of treatment that prevent the occurrence of blood cancers and cause as few late effects as possible. The group consists of four doctoral candidates and two postgraduate students.



<https://www.helsinki.fi/en/researchgroups/hematological-genetics>

BOUNCE

**PhD Paula Poikonen-Saksela's and
Adjunct Professor Johanna Mattson's group**

BOUNCE is an EU-funded multinational research project that aims at predicting effective adaptation to breast cancer to help women to BOUNCE back. A predictive tool to assess individual resilience and to tailor individual support will be created to enhance efficient recovery from breast cancer and help patients to remain in the workforce, cope at home and enjoy a better quality of life.



RESEARCH

KEY PROJECTS AND FUNDING

KEY PROJECTS AND FUNDING

HUS's Comprehensive Cancer Centre is the largest center for cancer research in Finland. The Comprehensive Cancer Centre performs both clinical and translational research concentrating on various types of cancer. Research includes both investigator-initiated studies in academic groups as well as cooperation studies with the pharmaceutical industry. We also cooperate with several national and international research networks. Our investigators participate in large-scale national projects, such as the FinnGen genetic information project where our investigators are in charge of the clinical group. The Comprehensive Cancer Centre's investigators also have an important role in the Academy of Finland's iCAN cancer flagship project (Digital Precision Cancer Medicine platform). The Division of Hematology leads the project for The Finnish Hematology Registry and Clinical Biobank, FHRB, and the Comprehensive Cancer Centre has had a leading role in the

founding and launch of the Southern Finland National Cancer Center, FICAN South.

In 2018, the Comprehensive Cancer Centre produced over 250 scientific publications. It is important to note that a significant number of these, nearly one in five, were published in international journals of very high impact factor (>10). Our high research activity is also evident in the fact that our investigators work as principal investigators in several multinational research projects concentrating on breast cancer, lymphoma, hematology, patients' quality of life and rehabilitation, for example.

Annually, the Comprehensive Cancer Centre launches 40 new studies, and in 2018, we had 180 ongoing clinical trials, of which over 90 were drug trials. Examples of significant contribution to research include the Comprehensive Cancer Centre's new unit for early-phase clinical trials, where several first-in-human trials are currently ongoing (page



250
scientific
publications

X), and boron neutron capture therapy (BNCT), where we will be the first in the world to begin research with the current technology.

Our investigators have been able to attract significant amounts of national and international funding. Our investigators coordinate two EU projects. In 2017, the Comprehensive Cancer Centre was chosen as the coordinator of a multinational EU-funded project Bounce, which aims to develop a resilience trajectory predictor of breast cancer patients. Our investigators also coordinate an EU project for personalized drug therapy of T-cell malignancies. The project has received funding from the European Research Council (ERC). Several of our research groups have received funding from the Academy of Finland, Business Finland, and from various foundations, such as Jane and Aatos Erkko Foundation, Luise och Henrik Kuningas stiftelse, and Sigrid Juselius Foundation. The Cancer Foundation Finland has also supported our research groups with several significant grants in the 2010s, most recently in 2018. In 2018, the Comprehensive Cancer Centre produced scientific research with outside funding of over 8 million euros.

In addition to clinical studies, the development of new cancer therapies requires multi-professional cooperation between the hospital's investigators performing clinical studies and the researchers developing new methods of laboratory and IT analysis. A great deal of the research in Comprehensive Cancer Centre is performed in Biomedicum's translational cancer research laboratory, and our investigators cooperate with the translational cancer research groups from University of Helsinki, as well as other organisations, such as the Institute for Molecular Medicine Finland FIMM. Digital analysis of enormous amounts of clinical data, artificial intelligence in health care development, and software for electronic patient reports will become the next key factor in cancer research. The Comprehensive Cancer Centre is in charge of several projects related to digitalization in health care. These projects include the Bounce project and HUS's CleverHealth ecosystem / eCare for Me projects that aim to improve diagnostics, cost-effectiveness, and patients' coping with their cancer treatments.



In 2018, the Comprehensive Cancer Centre produced over 250 scientific publications.



COOPERATION

iCAN

Pathology and the Biobank,
FinnGen

FIMM

Cancer Biology

Cancer Genetics

Tumor Groups

FICAN South

Syöpöklinikan tuki ry

COOPERATION

iCAN

iCAN



Tomi P. Mäkelä
Executive Officer,
iCAN Digital Precision Cancer
Medicine Flagship

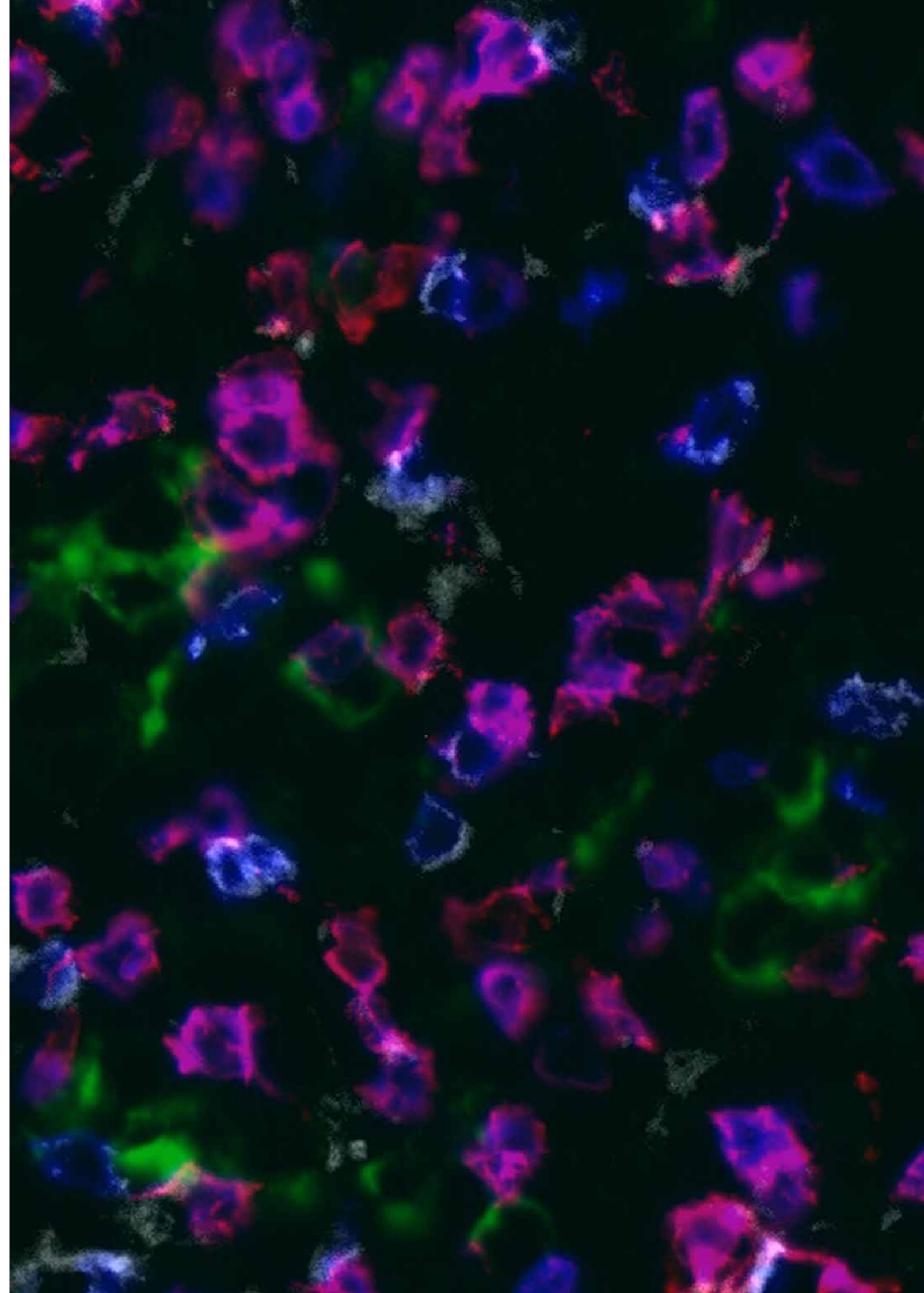
Professor Tomi P. Mäkelä is Executive Officer of the recently launched iCAN Digital Precision Cancer Medicine Flagship and Vice Director of the Center of Excellence in Translational Cancer Biology. His group's interest focuses on cell growth signaling and its deregulation in cancer with special emphasis on the tumor microenvironment and tumor suppressor LKB1 signaling.

iCAN is one of six national flagships in Finland 2019-2026 aiming to develop nuclei of scientific excellence into competence clusters for discoveries, innovations, and societal and economic impact. In iCAN a platform joining Digital Health and Precision Cancer Medicine is established for discoveries and improved treatments.

The iCAN Digital Precision Cancer Medicine platform integrates living biobanks, immune profiling, ex vi-

vo drug screening, and genetic variation with unique Finnish digital health inputs including those from Helsinki University Hospital HUS datalake, registries and patient reported outcomes. The platform will be developed within pilots in colon, breast and ovarian cancer as well as hematological malignancies and leiomyoma with potential to be applied in various other cancer types. HUS Comprehensive Cancer Center researchers are critical participants in iCAN.

Patient involvement and empowerment at all stages is a key aim in iCAN. The University of Helsinki and HUS Helsinki University Hospital act as founding hosts of iCAN aiming to create a competence cluster with significant long-term investments from companies in the pharma/digital health sector as well as other public and third sector partners nationally and globally.



COOPERATION

PATHOLOGY, BIOPANK AND FINNGEN

DYNAMIC DIAGNOSTICS AS PART OF THE CARE CHAIN



An international leader in laboratory testing

- Around 430,000 tests annually
- 57 doctors
- 95 bioanalysts
- 23 specialist employees
- research and development work

The basic task of pathology is to use microscopy to diagnose cancer from tissue and cell samples. However, pathology and genetics have advanced from a purely diagnostic role to become an integral part of the entire patient care chain. HUSLAB carries out centralized pathological and genetic testing at three different laboratories. Its activities also include field-related research and product development, which play a key role in maintaining cutting-edge diagnostics in pathology and genetics on an international level.

Strong developments in the industry have introduced modern testing tech-

niques – such as immunohistochemistry, flow cytometry, and molecular genetic and cytogenetic testing – and has led to the division of cancers into several subtypes, each with their own prognosis and care response. For example, in Immunohistochemistry, HUSLAB uses a range of 400 antibodies, which is extensive on an international scale. Meanwhile, the rapid development of molecular genetics testing has allowed for the more accurate monitoring of cancers, prognosis assessment, and individualized, targeted cancer treatment.



MEILAHTI CAMPUS BIOBANK – PROMOTING THE DIAGNOSIS AND CARE OF CANCER PATIENTS

Biobanks are an increasingly important resource in modern translational research. Translational research bridges the gap between basic research and patient care and enables, for example, individualized treatment programs for cancer patients. As a clinical biobank, the Helsinki University Hospital Specific Catchment Area's biobank supports the research of its member organizations, and networks with other national and international biobanks. One of its strengths is the collaboration with clinics and research groups that develop cancer treatments, including the Center of Excellence in Translational Cancer Biology.

The aim is to provide Ethics Committee-approved research projects with access to previously

collected samples, as well as to new samples taken for diagnostic, treatment and monitoring purposes. The biobank will also support hospital districts' research strategies, the University of Helsinki's research strategies, and regional research strategies.

Comprised of regional partners

- HUS Helsinki University Hospital
- University of Helsinki (HY)
- South Karelia Social and Health District (Eksote)
- Joint Authority of Kymenlaakso Social and Health Services (Kymsote)



THE FINNGEN RESEARCH PROJECT

Arno Palotie

Launched in fall 2017, FinnGen is an extensive public and private sector research project that aims to produce genetic information from 500,000 Finnish biobank sample donors. Cancer is one of the FinnGen project's priorities, and researchers from the HUS Comprehensive Cancer Centre, as well as a significant number of its patients, are taking part in the study. The FinnGen research project is coordinated by the University of Helsinki's Institute for Molecular Medicine Finland (FIMM), with Professor Aarno Palotie acting as Scientific Director for the project.

The FinnGen study produces genetic information from blood samples collected by Finnish biobanks. Combining genome information with health care data from registries increases our un-

derstanding of the pathogenetic mechanisms of diseases. At the same time, FinnGen allows for the identification of genetically verified targeted pharmacotherapies and for the development of new individual therapies, including for cancers.

The Comprehensive Cancer Centre is participating in the FinnGen study on many levels. The Comprehensive Cancer Centre and Helsinki Biobank make up a highly significant share of FinnGen's nationwide sample collection - patients at the Comprehensive Cancer Centre can participate in the study by giving their consent to providing a biobank sample. Almost 25,000 Finns diagnosed with cancer had participated in the FinnGen study by April 2019. Researchers at the Comprehensive Cancer Centre also lead FinnGen's group of cancer specialists.

COOPERATION

FIMM

FIMM – THE INSTITUTE FOR MOLECULAR MEDICINE FINLAND

Top International Research

- About 250 people, representing almost 30 different nationalities. Operations began in 2008.
- Hosted by the University of Helsinki since 2017 one of the operational units of the Helsinki Institute of Life Science (HiLIFE)
- A Finnish node of the Nordic EMBL Partnership for Molecular Medicine and a member of EU-LIFE
- Approximately 240 articles in international scientific journals published each year
- Coordinates the ambitious FinnGen study combining genomic information with digital health care data of 500,000 Finns
- Coordinates the Academy of Finland Centre of Excellence in Complex Disease Genetics and is engaged in the iCAN cancer flagship project
- Integrates the latest technology infrastructures, biobanks and molecular medicine research for patient benefit



Rapid translation of cancer research for the benefit of patients

The Institute for Molecular Medicine Finland (FIMM) is a translational research institute focusing on human genomics and precision medicine. Collaboration with biobanks and clinics, particularly with the HUCH Cancer Center, is a key part of the institute's activities.

FIMM is a global pioneer in the development of personalized precision therapy for cancer. The institute has developed methods for predicting the response of cancer patients to therapies.

This is based on genomic information and functional drug sensitivity testing of patient cells. The method will also help prioritizing new drugs to be brought for clinical trials. In projects on hematological cancers and solid (for example ovarian and urological) tumors, precision therapy is developed in cooperation with clinicians from HUH Cancer Center. Furthermore, digital molecular pathology is established at FIMM to improve novel cancer diagnostics based on imaging and machine learning.



Mark Daly

Mark Daly, the current Director of FIMM, is a distinguished scientist who has made major contributions to human genetics and genomics during his 20-year career. He was recruited from the Broad Institute of MIT and Harvard and Massachusetts General Hospital to Helsinki in 2018. He has made seminal discoveries in understanding the details of the structure of the human genome and developing software tools to analyze the impact of genetic variations on various diseases, with special interest in autism, ADHD and other psychiatric diseases as well as inflammatory diseases. He has over 400 scientific publications with over 130 000 citations.



COOPERATION

CANCER BIOLOGY

CENTRE OF EXCELLENCE IN TRANSLATIONAL CANCER BIOLOGY: PRODUCING GROUND-BREAKING RESULTS



Kari Alitalo
Academy Professor

The Centre of Excellence in Translational Cancer Biology is a multidisciplinary research program that has garnered numerous international awards for its ground-breaking cancer research. The group's areas of first-class expertise include the function of cancer genes, cancer stem cells, cancer angiogenesis, targeted drug screening, and translational technology.

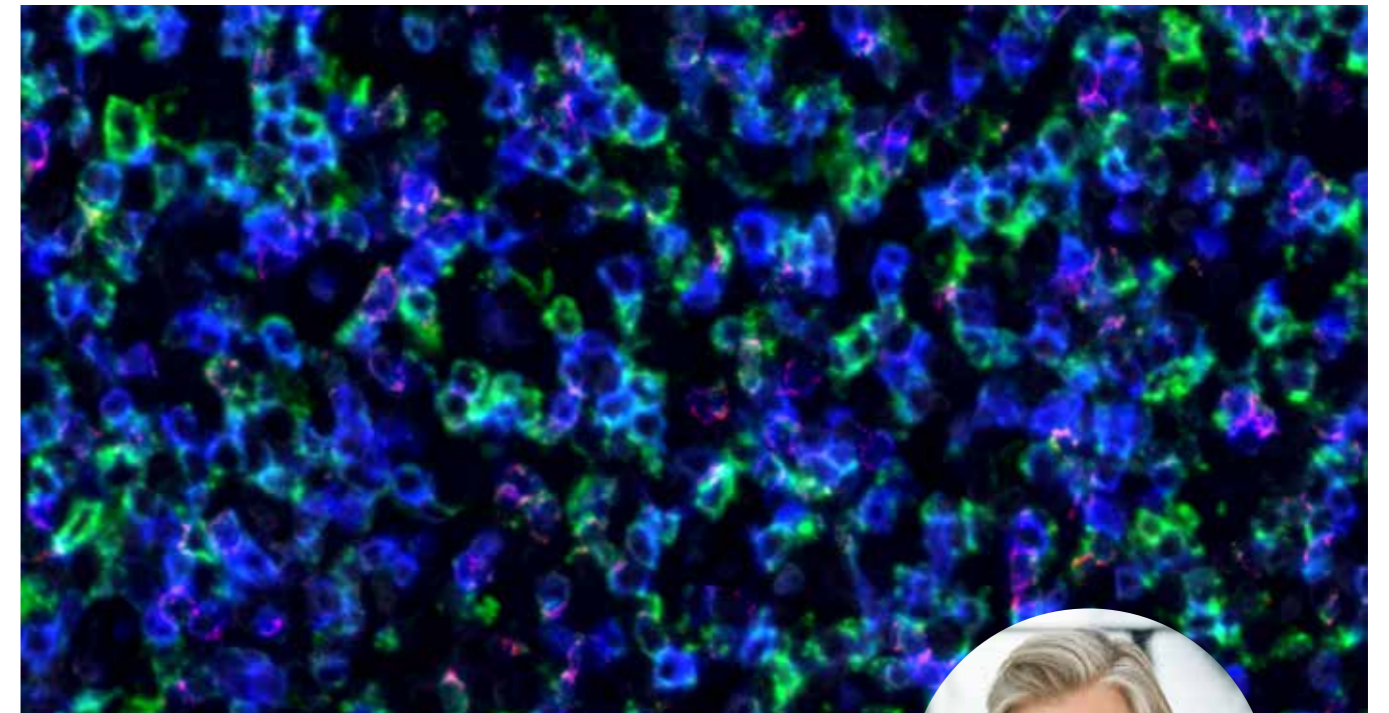
Together these areas form a strong Finnish centre of excellence for translational cancer biology research that also trains experts in this field that is critical for the future. The centre's goal is to develop new therapies with the help of gene and stem cell research, three-dimensional cell culture models produced from patient tumors, in-vivo research models, and drug screening. A new type of cellular model enables examining the function of molecules discovered through high-quality imaging and testing new therapies in an environment that is more physiological in nature than traditional cell cultures. By combining research results achieved via different methods, significantly better understanding can be reached regarding cancer metastasis mechanisms, for example. This in turn

creates the foundation for developing more effective, targeted cancer drugs.

The centre of excellence studies and tests completely new therapy strategies for preventing cancer growth and spread, and develops new diagnostic tests and selection methods for cancer drugs so that therapy can be optimized individually. The centre has had research breakthroughs involving suppression of tumor lymphangiogenesis and angiogenesis that have already progressed to in-patient trials.

The centre of excellence brings together high-quality research groups from University of Helsinki and University of Turku. The groups are led by eight top cancer researchers and they work in close collaboration with VTT Technical Research Center of Finland, HUS Helsinki University Hospital, National Institute of Health and Welfare, and Turku University Hospital.

Professor Alitalo is known as a leading expert and key researcher for his pioneering work to increase understanding of pathophysiology of cancer and its metastases. Consequently, Professor Alitalo is among the most referred scientists in Europe.



Juha Klefström

SYNTHETIC LETHAL APPROACHES TO INDUCE IMMUNOGENIC CELL DEATH AND TREAT BREAST CANCER

Klefström laboratory strives to advance research from the bench to early clinical development by focusing on therapeutic strategies aiming to exploit oncogene-induced vulnerabilities in cancer. Klefström has a total of over 20 years of experience in cancer biology, including 15 years as an academic lab head and 10 years as a coordinator, leader and founder of multiple international public-private partnerships involving major pharmaceutical industries. The laboratory studies therapeutically intervenable metabolic vulnerabilities caused by oncogenic MYC protein, synthetic lethal approaches to treat breast cancer and several strategies to boost immunotherapies via immunogenic cell death.

Moreover, they develop and test chemical tools to explore opportunities in intervention of oncogenic transmembrane serine proteases, especially hepsin. Klefström laboratory has established a variety of three-dimensional culture systems and patient tumor-derived breast explant cultures for ex vivo target validation, drug testing and for studies of breast cancer development. The PI has special expertise in breast cancer biology, oncogenes, synthetic lethal strategies, preclinical genetically engineered mouse models, ex vivo organoid cultures and recombinant viral gene/shRNA/CRISPR gRNA transfer methods.

COOPERATION

CANCER BIOLOGY

THERAPEUTIC BIOMARKERS FOR TARGETED TREATMENT OF GASTROINTESTINAL STROMAL TUMORS (GIST) AND HEAD AND NECK SQUAMOUS CELL CARCINOMA (HNSCC)

Despite substantial advancements in the targeted treatment of cancer, certain tumors do not respond to treatment or develop resistance to current anticancer therapeutics. The group's aim is to explore the molecular genetic characteristics and putative drug response biomarkers for two cancer types that are challenging to treat: advanced gastrointestinal stromal tumors (GIST) that no longer respond to other approved treatments as well as human papilloma virus negative head and neck squamous cell carcinoma (HNSCC), for which no reliable biomarkers exist for the targeted thera-

peutics. To identify drug response biomarkers and oncogenic drivers that contribute to the growth of these tumors, they are exploiting several genomics approaches, patient-derived cell lines and ex vivo three-dimensional tumor cultures that better represent the original tumor in terms of heterogeneity, molecular profile, and drug responses. Combining the modern molecular biology tools with excellent clinical material and expertise at the HUS Comprehensive Cancer Center, they hope to transfer our molecular findings into the benefit of cancer patients.



Outi Monni

CANCER CELL BIOLOGY GROUP

www.helsinki.fi/en/researchgroups/cancer-cell-biology

Cancer Cell Biology group led by Professor Päivi Ojala Cancer Cell Biology group at the Translational Cancer Medicine Research Program (CANPRO), Faculty of Medicine, is focused to study the role of lymphatic endothelium in the tumor microenvironment and its contribution to cancer metastasis. The group is interested in the changes in the tumorigenic properties of the cancer cells upon contact with the lymphatic endothelium, and also in the changes induced in the lymphatics by the tumor cells. They are also using Kaposi sarcoma herpesvirus (KSHV), an oncogenic human

gamma-2 herpesvirus, as a model system to study cancer development and progression. Ultimately, their studies aim to identify novel signaling pathways and key proteins critical in cancer metastasis and viral cancers, which could open new leads that can be pursued for novel intervention and therapeutic strategies. More recently, they have joined a new collaborative project involving cell-based, pre-clinical and translational studies with the goal to develop a first-in-man trial of CAR-T therapy of solid cancers.



Päivi Ojala



COOPERATION
CANCER GENETICS

CANCER GENETICS RESEARCH

The Finnish Center of Excellence in Tumor Genetics Research combines four top research groups. Both benign and malignant tumors are a combination of two genomes: a person's own genome, the germline, and the tumor genome. This setting, further complicated by tumor heterogeneity, is one of the key challenges in medical research, and multidisciplinary collaboration is a requirement for success in this research field. The discovery of significant cancer predisposing genes has increased our understanding of the basic mechanisms of malignant tumor growth, and fast development of genome sequencing technologies has re-

cently made it possible to analyze whole genomes, both human and tumor. Cancer genetics is a key field of medical research, in which Finland and this consortium have excellent traditions at the highest international level. The Centre of Excellence consists of four top research groups representing multiple complementary disciplines from epidemiology and genetics to bioinformatics and systems biology. The groups take advantage of the powerful synergistic combination of advancing technologies, unique national materials, and sophisticated data analysis methods to develop and validate disease models. The end goal is to translate the molecular findings into clinical benefits.



Lauri Aaltonen

Research of the highest level

- Four research groups: two from the University of Helsinki, one from Tampere University, and one from the Finnish Cancer Registry
- Academy of Finland funding for 2018–2025
- 9.4 million euro funding for the first four-year term
- As of now, there is already one Nature magazine publication by the Center of Excellence, regarding transcriptional regulation of the genome, among several other high impact publications.



TUMOR GROUPS

Multidisciplinary care meetings decide on patient-specific treatment. Meetings are held regularly, usually once or twice a week. Multidisciplinary care meetings are attended by top experts in the diagnosis of cancer and in surgical and oncological treatments. The Comprehensive Cancer Centre also has its own multi-professional tumor groups for all cancers which create and update disease-specific treatment recommendations in real time in accordance with new, significant research findings.

Breast cancer

Breast cancer is the most common cancer in women with more than 5,000 women diagnosed in Finland each year. For the majority, the disease is diagnosed in the early stages (a tumor in the breast and possible metastases in the axillary lymph nodes), and most patients will recover. Surgery is the cornerstone of treatment, after which the removed tumor is classified and an oncologist plans adjuvant systemic treatment (involving hormones, chemotherapy, or anti-HER2 treatment) based on the type of tumor.

The breast cancer tumor group monitors international developments in breast cancer treatment and actively participates in both national and international drug trials. The members of the tumor group also act as partners to specialist doctors or as consultants at outpatient clinics treating breast cancer patients, and they participate in all aspects of the development of breast cancer treatments. The Finnish Breast Cancer Group works closely with the breast cancer tumor group and the investigator-initiated clinical trials it leads are an important focus area in research, involving patients from all over the world. The tumor group collaborates closely with campus researchers on projects such as the iCAN project.

Group leaders:
 1 Marjut Leidenius and 2 Johanna Mattson



Group leaders: Riikka Huuhtanen and 1 Katriina Peltola

Bowel cancer

Bowel cancer is a cancer that originates in the small intestine, large intestine or rectal glands. Each year just under 3,500 new cases are diagnosed, and bowel cancer is the third most common cancer in Finland after prostate and breast cancer. Localized cancer in the intestinal wall is treated with surgery, while rectal cancer is treated with a combination of surgery and radiation therapy. Chemotherapy can be given as adjuvant therapy after surgery, and in cases of rectal cancer, may also be given before surgery in connection with radiotherapy. Metastatic bowel cancer is treated with a combination of chemotherapy and new biological systemic treatment. Isolated metastases may also be surgically removed, especially if they are located in the liver or lungs.

Gastric and pancreatic cancer

Approximately 1,700 Finns are diagnosed with gastric or pancreatic cancer each year. The symptoms of pancreatic cancer are rather vague, which means that it often goes undiagnosed until it is at an advanced stage. Treatments for pancreatic cancer include surgery, chemoradiotherapy or chemotherapy. Pancreatic cancer usually refers to adenocarcinoma of the pancreas, but other rarer forms of cancer can also occur in the pancreas. Gastric cancer on the other hand, originates in the glands of the stomach lining. The initial symptoms of stomach cancer are usually mild. Surgery is the key form of treatment for localized gastric cancer, but it is most often accompanied by chemotherapy. Advanced gastric cancer is primarily treated with chemotherapy and, in some patients, with targeted medication.

COOPERATION

TUMOR GROUPS

Testicular cancer

Testicular cancer is the most common cancer in young men, with around 170 patients diagnosed in Finland each year. The first symptom of testicular cancer is a swelling or lump in the testicle. The most important form of treatment is surgery, which also reveals the subtype (seminoma or non-seminoma) of the testicular cancer. Depending on the subtype of tumor, chemotherapy or radiation therapy are used to treat metastatic testicular cancer. Residual tumors are removed in a surgical procedure, if necessary. The prognosis for testicular cancer is excellent, and almost all patients recover.

Group leader: ① Susanna Mannisto



Prostate cancer

Prostate cancer is the most common cancer in men. More than 5,000 new cases are diagnosed each year. Localized prostate cancer is treated using external and/or interstitial radiation therapy, surgery or active surveillance. HDR brachytherapy and hypofractionated radiotherapy are well-established treatments at the Comprehensive Cancer Centre.

Group leader: ① Tapio Utriainen

For metastatic prostate cancer, new hormonal drug treatments in particular have changed the course of the disease and improved the prognosis. Research is under way at the Comprehensive Cancer Centre to investigate e.g. a new form of treatment with 177Lu-PSMA, which is not yet available in public healthcare elsewhere in the Nordic countries.



Lymphoma

Lymphomas are divided into two main types: Hodgkin's lymphoma and non-Hodgkin's lymphoma, or mature T and B cell lymphomas. Roughly 1,500 new cases of lymphoma are diagnosed in Finland each year. Lymphoma treatment is constantly improving: treatments include chemotherapy, antibodies, cell thera-

pies, radiation therapy, stem cell transplantation and combinations of these. The lymphoma group actively participates in international investigator-initiated and industry-commissioned clinical trials. The Nordic Lymphoma Group works closely in partnership with the tumor group.

Group leader: ① Sirpa Leppä

Gynecological cancers

Around 1,600 women are diagnosed with gynecological cancer each year in Finland. The majority of these, about 80%, are made up of cancer of the uterine corpus and ovarian cancer. The primary form of treatment for gynecological cancers is surgery. Chemotherapy and/or radiation therapy can be used as adjuvant therapy depending on the cancer's origin, metastasis and other predicted factors.

Group leader: ① Mikko Loukovaara



COOPERATION

TUMOR GROUPS

Lung cancer

On average, more than 2,600 Finns are diagnosed with lung cancer each year. Around 80% to 90% of cases are caused by smoking. Lung cancer is usually diagnosed from X-rays and is treated with systemic treatment, surgery, radiation therapy, or combinations thereof.

Group leader: Aija Knuuttila and
1 Pauliina Kitti (Radiotherapy)



Sarcoma

Sarcomas are malignant tumors of the bone or soft tissue. Sarcomas are relatively rare, with only around 240 new cases diagnosed in Finland each year. Treatment plans are drawn up for individual patients and may consist of surgery, pharmacotherapy, radiation therapy, or a combination of these.

Group leader: 1 Riikka Nevala



Brain tumors

Brain tumors are treated at the Comprehensive Cancer Centre with radiation therapy, chemotherapy, or a combination of the two. Developments in radiation therapy are reflected in the treatment of brain tumors, where the precise planning of therapy is key. Approximately 1,000 brain tumors are diagnosed in Finland each year, with gliomas and meningiomas being the most common.

Group leader: 1 Päivi Halonen



Neuroendocrine cancer

Neuroendocrine tumors are rare and can develop in any organ. They are most commonly found in the intestines and many of them secrete hormones, which cause symptoms that vary greatly from patient to patient. Treatment options include surgery, systemic treatment, 177-lutetium-octreotate therapy or follow-up.

Group leader: 1 Maija Tarkkanen



Head and neck cancers

About 800 new cases of head and neck cancer are diagnosed in Finland each year, most often in the pharynx, larynx, and oral cavity. The main forms of treatment are surgery and radiation therapy, as well as a combination of these (chemoradiotherapy).

Group leader: 1 Venla Loimu



Thyroid cancer

Thyroid cancer is more common in women than in men. Around 350 new cases of thyroid cancer are diagnosed in Finland each year. First, surgery is performed to remove the thyroid gland. This is most often followed by radioiodine therapy to destroy any remaining thyroid or cancer tissue.

Group leader: 1 Päivi Halonen



Urinary cancer

Around 2,000 Finns are diagnosed with urinary cancers – renal or bladder cancer – each year. Urinary cancers are more common in men. The main form of treatment for renal cancer is surgery. The treatment of bladder cancer is assessed on an individual basis, considering e.g. the extent to which the cancer has spread, and varies from superficial instillation, bladder surgery and/or radiation therapy or systemic treatment. Today, new targeted medicines are used to treat metastatic renal cancer.

Group leader: 1 Petri Hervonen



Melanoma

Around 1,300 cases of melanoma are diagnosed in Finland each year. The main form of treatment for melanoma is surgery, which also removes some of the healthy tissue around the melanoma. The Comprehensive Cancer Centre provides systemic treatment and radiation therapy for melanomas. HUS Helsinki University Hospital also provides some special surgical systemic treatment treatments, such as isolated limb perfusion (ILP).

Group leader: 1 Micaela Hernberg

COOPERATION

FICAN SOUTH AND SYÖPÄKLINIKAN TUKIJAT RY

FICAN SOUTH BRINGS TOGETHER CANCER CARE PROFESSIONALS IN SOUTHERN FINLAND

The Southern Finland Regional Cancer Center FICAN South was launched at HUS Helsinki University Hospital in 2018. The Southern Finland Regional Cancer Center comprises HUS Helsinki University Hospital, the University of Helsinki, which is responsible for medical research and education, the Päijät-Häme Joint Authority for Health and Wellbeing (PHHYKY), the Kymenlaakso Social and Health Services (Kymsote) and South Karelia Social and Health Care District (Eksote).

The role of the Southern Finland Regional Cancer Center, or FICAN South, is to coordinate the diagnosis and treatment of cancer and to promote cancer research in Southern Finland. The Southern Finland Regional Cancer Center operates in connection with the HUS Comprehensive Cancer Centre and collaborates with all parties treating cancer. A steering group began operating in early 2018, and clinical and scientific research working groups

are initiating activities. FICAN South has supported joint projects between clinical and translational researchers as well as joint projects between HUS Helsinki University Hospital and central hospitals. FICAN South has coordinated e.g. the production of the first national FICAN treatment recommendation for bowel cancer, the piloting of an occupational therapy model aimed at people diagnosed with cancer as young adults, and the introduction of benchmarking for cancer treatment within the specific catchment area.

The southern region's, or Helsinki University Hospital Specific Catchment Area's cancer center FICAN South is one of the National Cancer Center Finland's (FICAN) five regional cancer centers to be set up in university central hospitals. Other regional cancer centers are FICAN East, FICAN Mid, FICAN North and FICAN West.

FICAN SOUTH

ETELÄINEN SYÖPÄKESKUS

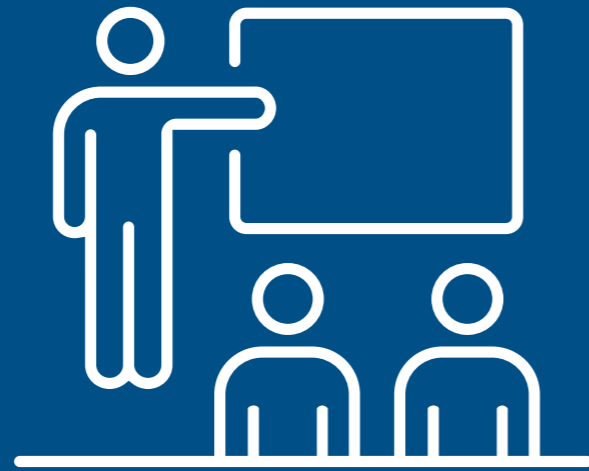


SYÖPÄKLINIKAN TUKIJAT RY - AN ASSOCIATION SUPPORTING COMPREHENSIVE CANCER CENTRE

The key aim of the association is to support the patients of Comprehensive Cancer Centre and their loved ones during the stressful hospital stay by making the hospital environment more comfortable. The association regularly maps out the needs of the patients together with the hospital staff. How donations are used is decided according to the wishes of the patients and their loved ones. The association also organizes events and publishes information booklets in cooperation with Association of Cancer

Patients in Finland (Suomen syöpäpotilaat ry). The association runs on volunteer work and donations.

Board members of Syöpäklinikan Tukijat ry in 2018: Ann Selin (Chair), Risto Kirjalainen (Vice chair), Inge-Brit Barkholt (Treasurer), Eeva Lind-Ekholm (Secretary), Minna Anttonen, Maarit Feldt-Ranta, Ulla Kotiluoto, Suvi Laru, Pirjo Lönnfors, Johanna Mattson, Hilikka Olkinuora, Susanna Soninen, and Marjatta Spankie.



Training for Physicians

Training for Nurses

EDUCATION

EDUCATION

MEDICAL STUDENTS

The philosophy behind the education is the “Master – apprentice” approach.

HUS Helsinki University Hospital's Comprehensive Cancer Centre is Finland's largest oncology training unit. As a teaching hospital it is responsible for the University of Helsinki's Faculty of Medicine's basic medical education in oncology, hematology and palliative medicine; for specialist medical education in oncology and hematology; and for post-graduate studies in the field. Breast surgery is a specialization option in both general surgery and plastic surgery. The period of residency in breast surgery varies from 3 to 6 months. In addition, a period of 1 to 2 months in breast surgery is elective for students undergoing surgery foundation training. The Comprehensive Cancer Centre also acts as a training unit for special qualification in palliative medicine.

Oncology training is led by Professor Sirpa Leppä and clinical teachers Paula Poikonen-Saksela and Annika Pasanen, while hematology training is headed by Professor Kimmo Porkka and Head Physician Ulla Wartiovaara-Kautto. Professor Tiina Saarto is responsible for training in palliative medicine. Professor Marjut Leidenius and Docent Tuomo Meretoja are responsible for breast surgery training. The Comprehensive Cancer Centre's docents and specialists participate in teaching. Collaboration with other university hospitals also takes place, such as when determining common learning objectives or producing and updating learning materials.

Basic education consists of seminars, mentoring and group teaching, and includes both theory as well as monitoring and participating in practical clinical work. Teaching makes use of coherent teaching methods and digital teaching materials. There were 150 medical students in 2018.

The Comprehensive Cancer Centre coordinated the oncology component of a

3-year national project launched in 2018 to digitize and harmonize medical education in Finland (Medigi) (<https://www.medigi.fi>).

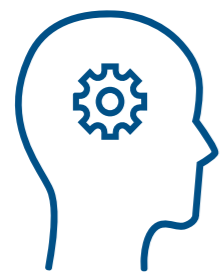
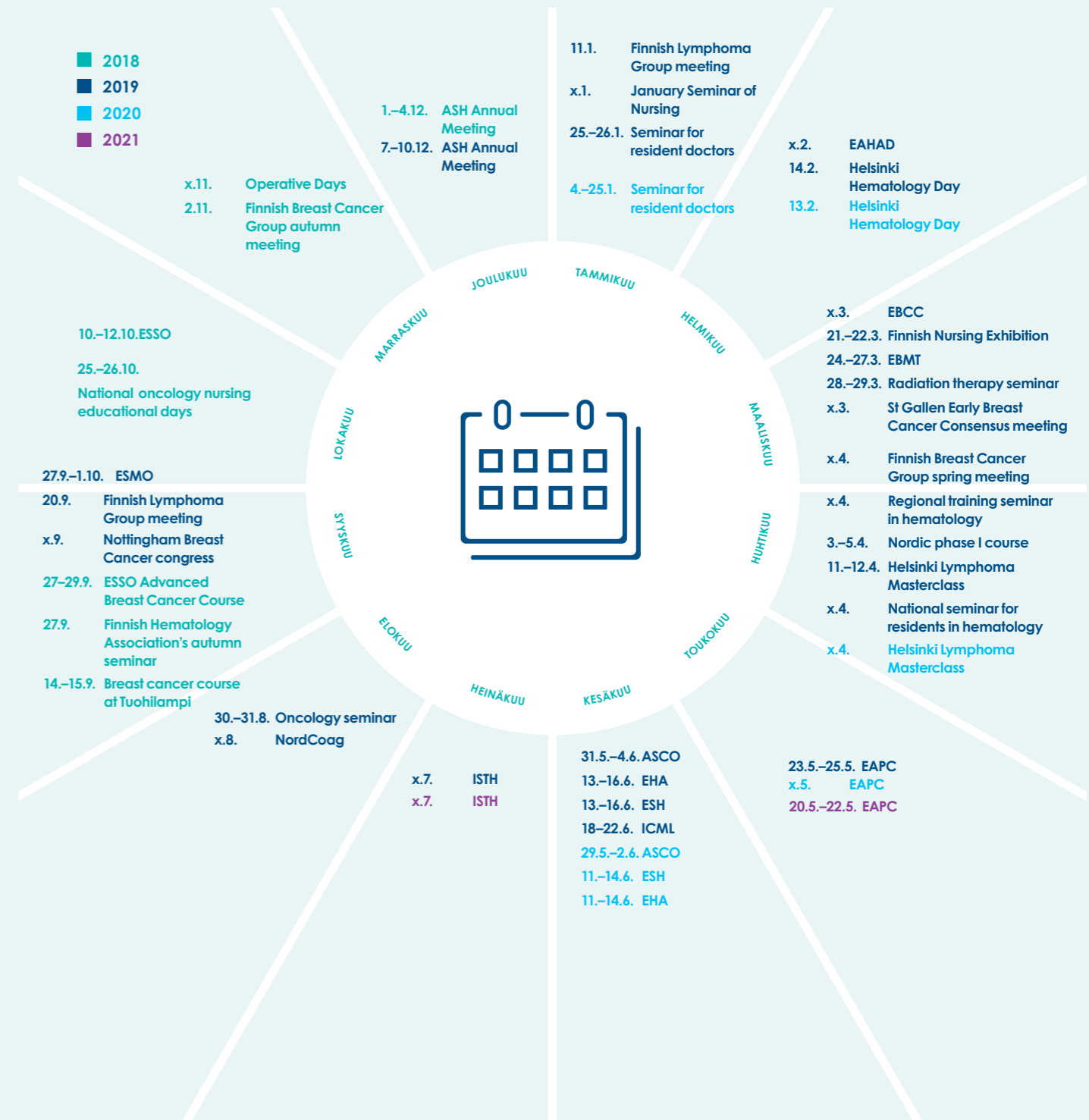
Specialist training is based on guided practical work and supplementary local, national and international theoretical education. The philosophy behind the education is the “Master – apprentice” approach. There are 20 doctors training to specialize in oncology, two of whom graduated as specialists in 2018. Two of these obtained a doctoral degree. There were four doctors studying to specialize in hematology, and three graduated as specialists. A log book compiled by the European Hematology Association (the European Hematology Curriculum, <https://ehaweb.org/education-2/education/european-hematology-curriculum/>) was introduced in hematology and harmonizes education both in Finland and in Europe.

Theoretical education is organized each week for personnel. Personnel actively organize and participate in national and international education.

In the spring of 2018, a national clinical cancer investigator course was organized and completed by 25 clinical investigators. In February 2018, the traditional Helsinki Hematology Day was held and attracted more than 100 practitioners and researchers in the field of hematology. 50 doctors attended the national Helsinki Lymphoma Masterclass organized annually by HUS Helsinki University Hospital.

Surgeons and oncologists from HUS Helsinki University Hospital's Comprehensive Cancer Centre participated as educators in the international Master of Reconstructive breast Surgery, Module I: Diagnostics and Oncology training program coordinated by HUS Plastic Surgery.

Training for physicians: annual wheel of events



Personnel actively organize and participate in national and international education.

TRAINING FOR NURSES

Around 150 nursing students undergo clinical training at the Comprehensive Cancer Centre each year.

The Comprehensive Cancer Centre offers its nurses the opportunity to develop at different professional career levels. In order to achieve OECE accreditation, the planning of advanced cancer care training for nurses began in 2013 and complied with the HUS Helsinki University Hospital's professional career model. Training was carried out in cooperation with the Metropolia University of Applied Sciences. Proficient-level training for cancer nurses (30 credits) began in December 2014, and Competent-level training (13 credits) followed in 2016. Radiographers and physiotherapists who treat patients with cancer can also sign up for the training. The training is offered to nurses at HUS and in the Hel-

sinki University Hospital Specific Catchment Area. The training model was extended to include mentoring in 2017 (7 credits) and supervisor training in 2018 (7 credits), offered to each department area. In 2018, the planning of advanced training in palliative care (7 credits) was also initiated for nurses working at the basic and A levels of palliative and hospice care in the Helsinki University Hospital Specific Catchment Area. In 2018, the Comprehensive Cancer Centre participated in the planning and implementation of HUS-wide training for research nurses (4 credits).

A harmonized induction program has been created for nurses from spring 2018 onwards. Nurses' skills are assessed us-



ing the Nurse Competence Scale (NCS), and radiographers are assessed using the Radiographers' Competence Scale (RCS). The Comprehensive Cancer Centre holds an annual Cancer Information Day for nursing students (≥ 100 credits) and a National Breast Cancer Day for nursing and physiotherapy professionals. The Comprehensive Cancer Centre hosts a number of public lectures each year and

open-house events are held on e.g. Women's and Men's days.

Around 150 nursing students undergo clinical training at the Comprehensive Cancer Centre each year. In addition, there are also Master's degree students in health sciences undergoing clinical training at the Comprehensive Cancer Centre almost every year. The quality of student supervision HUS is meas-

ured digitally using the Clinical Learning Environment Scale (CLES). The figure for the quality of student supervision at the Comprehensive Cancer Centre in 2018 was 9.01 (0-10). The result was the second best in the entire HUS.


www.hus.fi/cancercenter


Stenbäckinkatu 9


P.O. Box. 180, 00029 HUS


Tel. +359 9 4711



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