

Steno Diabetes Center Copenhagen

Annual Report 2023



Contents

We must benefit the entire healthcare system	3
New focus areas – new organisation	4
Department of Diabetes Care	6
Research	10
Clinical epidemiology.....	10
Complications research	11
Type 1 diabetes.....	14
Diabetes technology	16
Type 2 diabetes.....	18
Health promotion research	22
Department of Knowledge Communication and Skills Development.....	26
Operations.....	30
Scientific output	33
Organisation	36
Quality indicators.....	40

We must benefit the entire healthcare system

Looking at the front page of our annual report, maybe you're wondering what Steno Diabetes Center Copenhagen and a baby have to do with each other?

The baby's name is Xenia, and she is the first baby born in our PRE-STORK research project (page 20). The project will determine whether changes in the lifestyle of overweight mothers before they become pregnant could have a positive impact on their baby's body fat mass. In fact, there is ever more research to indicate that the seeds of developing diabetes have already been planted before someone is born.



We – and our users in particular – also know that life doesn't happen at either Steno or other hospitals, but in our own homes, in everyday life, at work, in schools...indeed, entirely outside the boundaries of the healthcare service.

Prevention plays a major role in the work we do at Steno – both at an individual and societal level.

At Steno, we strive to offer the very best treatment and to conduct research that can make that treatment even better. But diabetes is not just diabetes. Diabetes also increases the risk of developing a range of comorbidities, where heart disease, in particular, is one of the most common and also one of the

most serious. In recent years, it has become increasingly clear that conditions such as obesity, cardiovascular disease and, to an extent, kidney disease are closely connected with diabetes – both as regards underlying disease mechanisms and ways in which we can prevent and treat them.

We therefore also focus on preventing not just diabetes in our work, but also cardiovascular disease, kidney disease, eye problems, foot ulcers and the psychosocial aspects of living with diabetes. During 2023, we also established a unit that specially focuses on diseases of the brain in diabetes: the Steno Diabetes Neuro Unit. These are all areas in which we will see further development at Steno in the years to come.

Over many years, Steno has built up knowledge of how to live a positive and long life with chronic illness. Our working methods and knowledge can be applied to other chronic conditions and diseases, as diabetes is a good model disease for understanding the dynamics between hospitals, general practice and local government.

We – and our users, in particular – also know that life doesn't happen at either Steno or other hospitals, but in our own homes, in everyday life, at work, in schools...indeed, entirely outside the boundaries of the healthcare service. In 2023, we commenced work on developing what we call an individualised, digitally assisted needs-based clinic. In other words, our services will be adapted to the individual's actual needs rather than following one model that is used by everyone.

Some people will attend Steno frequently, while others might be satisfied with just one visit a year and otherwise benefit from new technologies at home.

We have to transform and innovate the healthcare service. By doing so, we will achieve an even better, more connected and more democratic healthcare service than exists today.



Magnus T. Jensen
CEO, professor
Steno Diabetes Center Copenhagen

New focus areas – new organisation

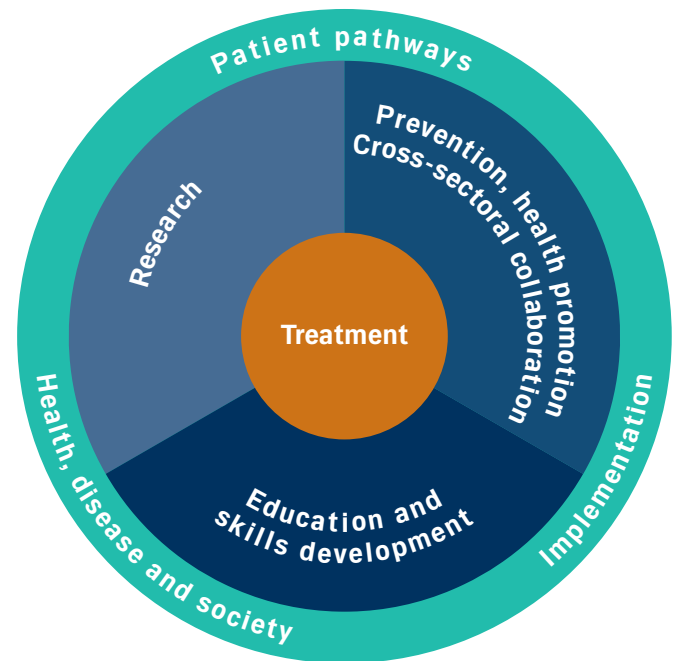
The Steno Wheel illustrates the managerial roles at Steno.

New areas of focus were introduced in 2023 to emphasise that Steno's expertise should benefit the entire healthcare service. Taking diabetes as a starting point, the strategic focus areas for 2027 in addition to existing roles are:

1. **Internationally renowned diabetes hospital:** Steno will strengthen its clinical position in the adult area as Scandinavia's leading diabetes hospital, and in the children and adolescent area as one of Europe's largest paediatric diabetes hospitals.
2. **Research and development hospital that benefits the entire healthcare service, and the area of chronic illnesses in particular:** Steno will link clinic, research and development to implementation, and ensure its relevance in both academic and clinical environments to the benefit of the healthcare service, both nationally and internationally.
3. **Relevance for the entire chronic area and how to live a good life with a chronic illness:** Steno will articulate and communicate its relevance as a representative for the entire chronic area in a public healthcare system, including by developing innovative and progressive patient pathways.
4. **Strengthen focus on the cardiometabolic area:** Steno wants to strengthen its research and development profile and collaborative interfaces within areas such as obesity, cardiovascular disease, central nervous system injury and other consequences of cardiometabolic disease processes.
5. **Innovative and progressive patient pathways:** Steno will take the lead within developing innovative, individualised, needs-based patient pathways, which utilise the technological opportunities within digital health and personalised medicine.
6. **Establish a Trial Unit and focus on practice-changing clinical research:** Steno will conduct research initiatives that challenge clinical practice.
7. **Strengthen focus on communication:** Steno will strengthen its position as a regional and national centre of excellence with expertise that is also relevant for other fields of chronic illness. Steno will thereby establish itself as one of the preferred providers of expertise, research and training.
8. **An arena for exchange and development of knowledge:** Steno will be strengthened as an area for holding meetings and conferences within Steno's subject areas. Steno's building will act as a natural base for holding symposia, activities with patient involvement and health professional and health policy activities, etc.
9. **Steno as a national voice for an integrated health service:** Moving toward 2027, Steno will become a notable strategic voice within prevention, integrated patient pathways, local health services and patient/user involvement.

The Steno Wheel

Treatment is, of course, at the heart of Steno Diabetes Center Copenhagen's work.



The Steno Wheel was introduced in 2023 and illustrates the managerial roles at Steno. Steno departments must not stand in isolation, but instead be interconnected teams that are mutually obliged to work closely together towards a common goal: strengthening the treatment of people with diabetes and preventing people at risk from developing diabetes.

New organisation

Organisational changes were made in 2023 to support areas of focus (see page 36).

The Clinic and CoreLab have merged to become the Department of Diabetes Care. The organisation of the Clinical Research Unit remains unchanged, but its name has changed to the Department of Clinical and Translational Research in order to signal the move toward strengthening the translational role. The Unit for Health Promotion Research has changed its name to the Department of Prevention, Health Promotion and Community Care, and has gained an additional role: cross-sectoral work in the regional context. The Education Unit is now called the Department of Knowledge Communication and Skills Development, and its role has thus been clarified.

Two four-year implementation units were established in 2024: the Steno Clinic for Precision Medicine and Steno

Digital. The purpose of the Steno Clinic for Precision Medicine is to strengthen the clinical implementation of precision medicine in patient pathways. The objective of Steno Digital is to establish a clinic-linked implementation unit so that Steno fully utilises the technical opportunities within digital health in patient pathways.

Third generation of supplementary treatment initiatives

A third generation of the supplementary treatment initiatives (STI) financed by the Novo Nordisk Foundation commenced in 2023 with the aim of improving patient pathways and diabetes treatment. This has led to a change in assessment criteria, procedure and organisation, with greater emphasis on the high methodological quality of supplementary treatment initiatives, so their effects can be classified and generalised to a greater extent.

At the same time, regional collaboration was strategically reinforced. This occurs in Steno Partners Forum, in which all of the Capital Region's hospitals participate, to improve diabetes treatment in the region.

Department of Diabetes Care

In October, the clinic and Steno Laboratory were merged to become the Department of Diabetes Care.

52.927

consultations were
held in 2023



10.665

people with diabetes
are linked to Steno



Close interdisciplinary collaboration is the distinguishing feature of the Department of Diabetes Care. Doctors, nurses, bioanalysts, ophthalmologists and ophthalmic nurses, podiatrists, dieticians, human physiologists and psychologists support interdisciplinary access to treatment, which ensures that there is a focus on self-care, nutrition, physical activity, mental well-being and relevant screening.

Relevant research will evolve and significantly benefit patients in the Department of Diabetes Care.

One of the major priorities is diabetes technology. The research has contributed, not least, to creating evidence of the beneficial effect of sensors and Automated Insulin Delivery (AID) systems.

Around 700 patients attending Steno with type 1 diabetes have already received the latest delivery system.



Nurse Linda Raimond shows Mette Kæstel some of the pump's functions.

Mette has swapped insulin pens for the latest pump

Mette Kæstel is one of approximately 50 people at Steno who have swapped insulin pens for an insulin pump in the last year. In the autumn, she received the latest automatic insulin delivery system because she had experienced several cases of severe insulin shock.

The new insulin pump automatically releases or interrupts the supply of insulin based on continuous glucose measurements from the sensor. But Mette was sceptical at first:

"I'm a little sad about moving away from the pen. Before I attended the course days, I was very sad

because I would be saying farewell to a system that I had relied on throughout the years since I developed diabetes aged 32. It felt safe, and I do like everything to stay the way it has always been," she explains, but she appreciates the safety net she feels it provides:

"It's actually a safety net for people who attend Steno, so you can ring if you need help. It's a great comfort, and I've made the choice not just to use the system, but also to have faith that it actually works and will help me."



18-year-old Alba Heiberg has always been happy to come to Steno but has had her last consultation at Steno's children's outpatient clinic, where her doctor throughout 16 years of living with type 1 diabetes has been consultant Birthe Olsen. Photo: Jane Aunsbjerg Villadsen.

New tool reduces no-shows among young people

It's the 18–24 age group who represent the majority of failures to attend at Steno. The use of dashboards has proven to be of great benefit in reducing no-shows.

Using weekly dashboards, children and adolescents who have previously failed to attend are contacted in the week before their planned appointment. The first trial showed promising results with up to a 50% reduction in the number of no-shows among young people.

Other projects

The future needs-based and digitally assisted diabetes outpatient clinic, Steno Life, is about to commence operations under new joint management.

The outgoing diabetes team is assisting with the diabetes treatment of inpatients. The organisation has been revised and implemented as a permanent service following the end of the supplementary treatment initiative.

The bioanalysts have undergone a focused organisation project, which has allowed greater independent work for the bioanalysts and improved well-being. The project resulted in a new organisation in “family teams” and “expert teams” with a high degree of self-leadership.

No-shows for dietician appointments have been reduced through development of a dashboard in collaboration with Quality & Data. A qualitative interview survey was conducted to identify the reasons for no-shows among people who previously failed to attend dietician appointments. New action areas were implemented.



Podiatrist Louise Barth received the Bagger-Sørensen Foundation's Appreciation Prize in 2023.



Majbritt Kjellmann made Diabetes Nurse of the Year.

The prize was awarded by the Professional Society for Diabetes Nurses.

Virtual consultations and a simpler planning tool have made the work of the Type 2 diabetes team more efficient, with increased focus on individual needs.

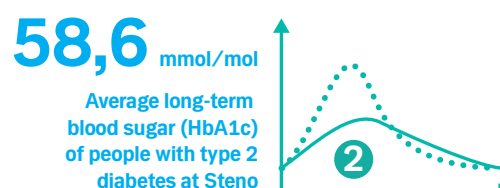
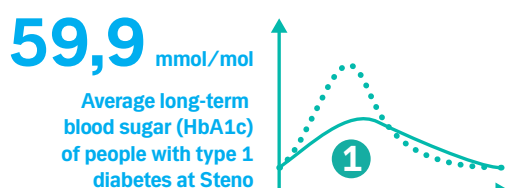
“The Learning Cabin” (part of the supplementary treatment initiative StenoIT) has created new frameworks and guidance for optimum telephone and video consultations.

The Foot Clinic has been involved in the development of new international guidelines for the treatment of the diabetic foot as part of the International Working Group on the Diabetic Foot (IWGDF).

New diet guidance has been drawn up for people with both diabetes and kidney disease. Steno's renal dietician has worked with other expert groups within nutrition, endocrinology and nephrology in the Capital Region of Denmark to implement the new guidelines (KDIGO). This occurred as part of a supplementary treatment initiative on kidneys.

Research

Clinical research and health promotion and prevention research is a vital cornerstone of Steno's work. The objective of the research projects is to generate new knowledge that ensures the best person-centred prevention or treatment of diabetes.



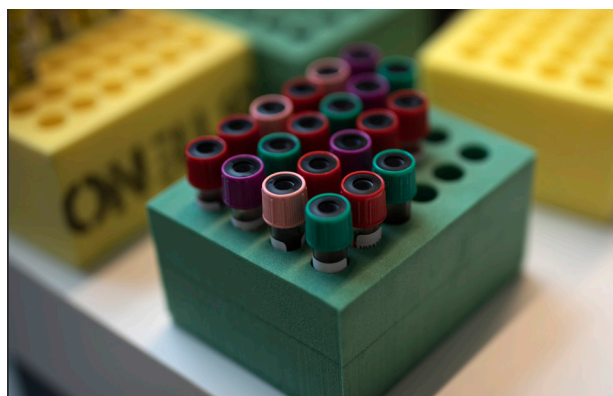
CLINICAL EPIDEMIOLOGY

The research group is working to identify people at risk of developing diabetes and complications, and also to find the best possible treatments and interventions.

- The **Steno T1 Risk Engine** screening method, which can predict cardiovascular disease in people with type 1 diabetes, is being updated. The more precise and contemporary method will benefit, among others, the forthcoming Steno 1 study and clinical practice.
- A comparison of **second generation insulins** (Gla-300 and Deg-100) in terms of HbA1c, hospital admission due to hypoglycaemia as well as fatalities among people with type 2 diabetes and simultaneous chronic kidney disease proved that the two treatment options were equally effective and safe to use. The study was published in *Diabetologia*.
- A trial simulation study showed that SGLT2 inhibitors and also GLP-1 analogues **protect against heart attack**, stroke and death to a greater degree than DPP4

inhibitors. The study is based on approximately 37,000 people with type 2 diabetes over 70 years of age.

- Does the climate have an impact on cardiometabolic risk factors? In the epidemiological part of the **PO-LAR study**, population data from approximately 2,500 adult Greenlanders were linked to meteorological data collected in the same period.



COMPLICATIONS RESEARCH

The research group is engaged in the prevention and treatment of both type 1 and 2 diabetes complications.

In 2023, the research group helped to establish PReclision MEdicine based on kidney Tissue Molecular interrogation in diabetic nEphropathy (the PRIMETIME consortium), which is a collaboration between endocrinologists, nephrologists and pathologists. A prospective cohort with research renal biopsies from people with both type 1 and type 2 diabetes has been created within the framework of the consortium. The group leads and participates in a range of studies that work with precision medicine so that biomarkers or modern imaging techniques can guide prognosis and treatment.

The researchers have witnessed numerous medical breakthroughs within the treatment of kidney disease in recent years. There are now indications that another medicine will be added to the ranks. An article in The Lancet describes how treatment with the drug BI 690517 can reduce albuminuria, a sign of kidney damage.

- In **DIA-HEART**, 900 people with type 2 diabetes but without known cardiovascular disease have had their heart function and structure investigated using PET-CT scans and echocardiograms. A preliminary analysis of 90 participants investigated using different methods demonstrated a connection between cardiac and renal problems.
- 1,700 people with type 1 or type 2 diabetes have been screened for neuropathy in the **DANES study**. The study demonstrated that neuropathy remains common in both type 1 and type 2 diabetes.
- **EMPA-SEMA** investigated whether GLP-1 (semaglutide) compared with placebo could reduce albuminuria in people with type 2 diabetes and kidney disease when treated with SGLT2 inhibitors. The study showed a tendency to improved nephroprotection in combined treatment.
- In the randomised **PROFOS** study, probiotics and fibre were shown not to be associated with beneficial effects on kidney function in people with type 1 diabetes and kidney disease.
- Do new treatment regimens for type 2 diabetes, such as SGLT2 inhibitors and GLP-1 receptor agonists, also work on people with type 1 diabetes and cardiovascular and kidney disease etc.? This is being investigated in the **Steno 1 study** (patient inclusion begins in 2024).
- Which treatment methods are of importance for cardiovascular disease and complications of type 1 and type 2 diabetes, among others? Two cohorts are being retrospectively investigated through follow-up of 1,000 people with type 1 diabetes and 1,000 people with type 2 diabetes, who were investigated using echocardiograms more than 10 years ago (the studies **“1,000 & 1”** and **“1,000 & 2”**). The oral health of the same patients is now also being investigated, with a particular focus on periodontitis.
- Can early detection of impaired heart function in people with type 2 diabetes, followed by targeted treatment, improve patients' prognoses in a cost-effective way? This is what **STENO HEART** (a supplementary treatment initiative) will determine.
- What is the effect of screening for heart disease using CT scanning combined with adjusted treatment in people with type 2 diabetes without known heart disease? The treatment is adjusted according to the degree of calcification in the heart. This is being investigated in the **IntenCT study**, which is a national collaboration between the Steno Centers, cardiologists and general practitioners.





"I enjoy flashing my sensor"

The water is only two and a half degrees at Svanemøllen in Copenhagen where 54-year-old Susan Freiber Thors-høj is winter bathing. She has had type 1 diabetes for 32 years and jumps into the water wearing her sensor.

"It works in both cold water and a hot sauna, and when I reconnect my pump again, I can see that my blood sugar has fallen to a slightly lower level – presumably because winter bathing is so wonderful and meditative. And it's really safe and super-easy with the sensor."

Susan is also happy to "flash" – as she says – her sensor while in swimwear:

"I feel it's so wonderful to recognise and empathise with other people, when you see their sensor. In the past, diabetes was a hidden disease. But you can spot your peers because of the sensor, and that's so wonderful."

TYPE 1 DIABETES

The research group is working within the paradigm shift that has occurred in recent years, in that type 1 diabetes is now also defined with pre-symptomatic stages. This means it's now possible to postpone the clinical début of type 1 diabetes with medical intervention at an early stage. This opens up opportunities for active detection, guidance and treatment.



At risk of type 1 diabetes? Active detection for children and young relatives is here

Danish and Norwegian researchers have found a way of arresting type 1 diabetes in children.

Children and adolescents who have siblings with type 1 diabetes are now being offered the chance to participate in a research project at Steno Diabetes Center

Copenhagen, which can tell whether they are at risk of developing type 1 diabetes.

This is detected using a simple blood test, which determines whether the person has autoantibodies to the beta cells that produce insulin.

If someone is positive for two autoantibodies, they are in stage 1. If someone has at least two autoantibodies and affected blood sugar regulation, but otherwise no symptoms, they are in stage 2.

Parents under 40 years of age who have children with type 1 diabetes, or children who have a mother or father with type 1 diabetes, will also be offered the chance to participate. In total, 750 people from Steno are expected to participate.

Professor, consultant, Dr. Med. Flemming Pociot is leading the research project, for which he has great expectations.

“That’s because I really believe that we can help people who are at risk. Before long, we expect to be able to offer medicine that can postpone diabetes for two to five years,” he says.

The drug that can postpone type 1 diabetes is called Telizumab and was approved by the American health authorities (FDA) in 2022. Flemming Pociot expects the medicine to be approved in the EU within one to two years.

In parallel with the detection programme, in 2023, Danish and Norwegian researchers might become the first in the world to document that type 1 diabetes can actually be arrested using antiviral medicine in children who have recently been confirmed to have type 1 diabetes. At the same time, they might prove that viral infection is one of the reasons why people develop the chronic insulin-dependent disease.

“We have believed that virus is a contributory cause to developing type 1 diabetes, and this appears to be correct. Our studies show that with the aid of antiviral medicine, we can arrest the development of type 1 diabetes, and that’s a massive breakthrough. It gives hope that, with time, we can actually prevent type 1 diabetes,” said professor, consultant, Dr. Med. Jesper Johannesen from Steno Diabetes Center Copenhagen and Herlev and Gentofte Hospital when the study was published in Nature Medicine in October.

6.654
people with type 1 diabetes
are patients at Steno.
Of these, 843 are children



Other projects

- Type 1 diabetes increases the risk of **shoulder, finger and hand pains** two- to four-fold compared with people without diabetes. The study based on a nationwide survey (a supplementary treatment initiative) was published in Diabetes Care.
- In collaboration with the Center for Basic Metabolic Research, Copenhagen University, the **MicrobLiver study** is focusing on the development and progression of liver disease. Steno was responsible for lipidomic and metabolomic analyses in the study. Lipidomics was also used to correlate with cardio-metabolic status in the **Target** project, which focused on child obesity.
- The **Proton** project has led to new studies in which one of the objectives was to develop ceramide markers in order to predict the risk of developing cardiovascular disease.
- A robust proteomics-pipeline has been established, which will search for **biomarkers for diabetic neuropathy**, as well as a multiomics project, which will map mechanisms and identify new biomarkers for diabetes complications.
- In the **INNODIA** project, with partners from 19 countries, the natural history of early type 1 diabetes progression was mapped and has led to clinical intervention studies in children and adolescents with newly diagnosed type 1 diabetes.
- How do we establish the best guidelines for early detection and clinical follow-up of people with pre-symptomatic type 1 diabetes? This is being investigated in the European action for the Diagnosis of Early Non-clinical Type 1 diabetes For disease Interception, the **EDENT1FI/DiaUnion** project, thorough investigation of first-degree relatives of type 1 diabetes patients.

DIABETES TECHNOLOGY

The research group plays a vital role, both nationally and internationally, in developing, testing and implementing new ways of using technological treatment tools.

91,7%

of all people with type 1 diabetes at Steno have sensors
98.3% of children under 18 have sensors



43,3%

of all people with type 1 diabetes at Steno have insulin pumps 77.4% of children under 18 have insulin pumps



- In a study published in Diabetes Care, **users of automatic insulin delivery** (AID) systems (i.e. pumps) at Steno had an almost 10 times higher odds-ratio for achieving all time-in-range recommendations (a blood sugar level within the normal range for 70 per cent of the day) than pen users with continuous glucose monitors (CGMs) without alarms. The study included glucose data from over 3,000 people with type 1 diabetes who use a CGM.
- **Prevention of skin problems** related to use of diabetes equipment was investigated in a skin protection programme, which involved the participation of 170 children and young people with type 1 diabetes. Participants, who were actively treated, achieved a reduction in the occurrence of ulcers and had a tendency to fewer infections after 12 months compared with the control group.
- One hundred insulin-treated people with type 2 diabetes participated in the **Steno2Tech** study, which demonstrated that the group treated with CGMs for 12 months experienced a number of benefits compared with the control group that used finger pricks: marked fall in HbA1c, increase in time-in-range and reduction in weight and insulin requirement.
- Are there positive effects, in addition to good glucose control, from using automatic insulin pumps, e.g. impact on sleep, cognition, blood pressure and heart rate, as well as inflammation markers? This will be investigated in **AID-BEYOND**, a randomised, controlled study of 100 children and 100 adults with type 1 diabetes in a collaboration with Steno Diabetes Center Aarhus.
- What is the sleep status of children and adolescents with type 1 diabetes who are treated with insulin pumps and sensors? This is being investigated in the **Sleep1child** study.



Doctor and researcher

Anna Korsgaard Berg,

who researches skin problems related to diabetes equipment, was awarded a research fellowship with the International Society for Pediatric and Adolescent Diabetes (ISPAD) and the Juvenile Diabetes Research Foundation (JDRF), as well as a postdoctoral grant from the Danish Diabetes and Endocrine Academy (DDEA).



“ We didn’t click with the doctor and got a different one

Anton: “It’s much better here than the containers we were in before!”

Milan: “Yes, there really are wonderful facilities here. On the other hand, whether you feel you’re receiving good treatment or not depends on the people you meet. At one time, we were talked to in a very preachy tone by Anton’s previous doctor. We didn’t click with the person, but now Anton sees someone else, and everything is good. We now experience an entirely different level of support and understanding. The major challenge, however, is that the advice you receive is a bit ‘one size fits all’. It can be difficult to apply it to the life you actually lead.”

Anton: “Yeah, I go dirt jump cycling for hours every week, and the first pump I had fell off all the time. Now I have one without a tube and that’s better, but I can’t work out how much insulin I need when I might bike 10 hours on one day and only two on the next.”

Milan: “Otherwise, it’s the little things that we wish could be different. For example, Anton has two appointments today with a 50 minute waiting time in-between – but we do enjoy the beautiful surroundings and get to play table football. The atmosphere is contagious, so it keeps you in a good mood.”

*Milan and Anton Kronborg, father and son.
Anton is 15 years old and has had
type 1 diabetes for three years.*

TYPE 2 DIABETES

The research group is working to understand the significance of genetic, environmental and lifestyle factors on type 2 diabetes, central nervous system disorders and also clinical prevention.

4.258

people at Steno have type 2 diabetes. Of these, 15 are children. 611 have a type of diabetes other than 1 and 2



Low birth weight is a new risk factor

Two studies published in Diabetologia demonstrated a strong connection between low birth weight and development of type 2 diabetes, as well as complications of diabetes and development of other disorders.

Birth weight turns out to be an independent risk factor on a par with genetics and family history: the smaller the baby, the greater the risk of developing type 2 diabetes.

One study shows that each time birth weight increases by one kilo, the risk of developing type 2 diabetes falls by 40 per cent.

The study included midwifery records that date back all the way before the Second World War. A total of 4,590

adults born in the years between 1939 and 1971 were included. The participants were drawn from the Inter99 study and were followed for up to 20 years until 2020.

The second study, which is based on DD2 data from 6,866 Danes who had recently been diagnosed with type 2 diabetes, showed that the less the participants weighed when they were born, the earlier they developed type 2 diabetes and vice versa.

A third study based on DD2 data also demonstrated in 2023 that people with type 2 diabetes who have a special gene variant were younger when they received their diagnosis, were less overweight and had more comorbidities of the small blood vessels at the time of diagnosis.

Other projects

RESET2, a controlled, randomised study involving 160 people with type 2 diabetes, will help to answer whether time-restricted eating could lead to weight loss and improvements in risk markers for type 2 diabetes and cardiovascular disease.

Steno-Verify (a supplementary treatment initiative) is a research project that will use biochemical and genetic markers to ensure correct classification of diabetes type among people with type 1 diabetes in the Capital Region.



**Senior researcher
Jonas Salling Quist**
received the Nutrients 2023 Young
Investigator Award for his research
focusing on time-restricted eating.

Neuro Unit explores the brain in research and treatment

A new clinical research unit will investigate how we detect and treat cognitive disorders and brain diseases as a consequence of diabetes.

Studies show that type 2 diabetes is connected with an increased risk of developing cognitive disorders. These can include forgetfulness, difficulty concentrating, sleep problems and ultimately dementia.

However, knowledge in the area is lacking. Steno therefore launched the Steno Diabetes Neuro Unit in autumn 2023. The interdisciplinary research unit will focus on why cognitive disorders occur, whom they affect and what we can do about them. The unit will collaborate broadly with other researchers and doctors within and outside of Steno, so the brain is scrutinised across specialties and expert groups.

The unit will, among other issues, find out how to best screen for cognitive disorders among people with

diabetes, whether diabetes medication such as GLP-1 analogues and SGLT2 inhibitors may be of assistance in preventing dementia, and what impact insulin resistance and inflammation of the brain has on development of dementia in those with diabetes.

One of the first actions of the Steno Diabetes Neuro Unit was to establish a team that could conduct a clinical cognitive test. The objective is initially to identify the best screening method.

A supplementary treatment initiative will contribute to developing and implementing a clinically usable procedure that systematically identifies people with type 2 diabetes and cognitive difficulties. In addition, the effect of multifactorial intervention is being investigated.



The Steno Diabetes Neuro Unit is led by consultant Jørgen Rungby.

The first Steno babies have been born

The PRE-STORK research project is investigating whether lifestyle changes prior to pregnancy can prevent obesity in the future child.

Xenia Paszczak (below) came into the world in September 2023 and is the first baby in the PRE-STORK research project. The study investigates whether a tailor-made, intensive change in lifestyle before pregnancy – and resulting weight loss – can prevent obesity in the future child.

“I think it’s important that we get smarter about the causes of obesity and how we can prevent it. I therefore had no doubts about wanting to participate in the project and supporting it,” explains Xenia’s mother, Adrianna Paszczak.

Laura Lyng Tjæreborg and Christoffer Munch Paulsen (right) are also participating in PRE-STORK and are excitedly anticipating their son’s arrival. They are jointly involved in PRE-STORK, in which partners can also participate.

“We would like to have children, and we would also like to lose weight. That’s why the project was really exciting for us. Being supported and guided throughout the entire process was a unique opportunity,” explains Laura Lyng Tjæreborg, who lost ten kilos before she became pregnant.

PRE-STORK will include 360 women in total, who will be followed before, during and after their pregnancies. The project is expected to conclude in 2028





HEALTH PROMOTION RESEARCH

The Department of Prevention, Health Promotion and Community Care is one of the country's largest and a leader within its field.

Help during school hours for children with type 1 diabetes

KIDS (Communicative Action on Diabetes in Schools) is a collaboration between all the Steno Diabetes Centers and the Danish Diabetes Association. In close collaboration with families, schools and local governments, the project group has uncovered the challenges faced by school staff, parents and children when a child with type 1 diabetes goes to school. Among other issues, the group revealed that three out of four children with type 1 diabetes cope with their diabetes on their own during school hours.

The project has developed a banded solution proposal for local and regional practice.

Type 1 - Diabetes Distress Scale (T1-DDS) has been developed to measure diabetes stress in people with type 1 diabetes. This is the first time that an abbreviated version of the diabetes distress scale has been developed and validated worldwide. T1-DDS-7 contains seven questions, with each question covering one of the seven sources of diabetes distress. The tool can thus provide rapid insight into which sources of diabetes distress represent the greatest challenges to the diabetes patient.



Around twice a month, Steno Diabetes Center Copenhagen holds a two-hour long course for teachers and educators who need to help children with type 1 diabetes.



Patricia DeCosta, PhD, post doc researcher, received the Danish Diabetes Association's research grant of DKK 600,000 for the PLAY study. The objective of the study is to develop a play-based approach to consultations with children aged three to seven years with type 1 diabetes. Photo: Nils Meilvang.

- **OPEN** is an EU-funded project on Open Source Automated Insulin Delivery. The project has formed the basis for guidelines as to what approach clinical staff should adopt in the case of patients who use unapproved insulin pump systems. Steno contributed to an international consensus document published in Lancet Endocrinology & Diabetes.
- **The Face-it** project has developed and evaluated a health promotion intervention targeted at women with previous gestational diabetes and their families. A total of 277 women and their families were randomised to either a control group or to receive the intervention, which ran from three to twelve months after birth and consisted of extra home visits and guidance from a project nurse as well as parallel digital health guidance and support. Preliminary results show that the intervention was well received by the families and delivered as planned, and also that a tailor-made approach is key to health promotion and prevention in this target group. Impact evaluation is expected in 2024.
- **Happy Healthy Children in Movement** is a social and health promotion initiative, whose purpose is to promote a healthy and active everyday life among three- to nine-year-old children and their families in vulnerable residential areas. The initiative focuses on social contact and outdoor activities incorporating play, food and nature, and involves around 1,200 children from

seven nurseries and three primary schools in Brønshøj, Husum and Tingbjerg in north-west Copenhagen. The initiative is research-based and takes the children's physical activity as the primary endpoint.

- **Move FGU** (introductory basic education - FGU) will help to develop groundbreaking new knowledge in forthcoming years on how – and whether – a system-oriented and data driven approach can contribute to increasing physical activity among young people in FGU schools, which have a significant population of young people at high risk of subsequently developing type 2 diabetes. Prior to the intervention itself, a nationwide questionnaire was conducted among all FGU employees, which identifies the schools' work within health promotion.



Tingbjerg project receives the Danish Diabetes Association's Action Award 2023

Steno Diabetes Center Copenhagen is one of the driving forces behind the supplementary treatment intervention project Integrated Diabetes Intervention in Tingbjerg, which was presented with the Danish Diabetes Association's Action Award in 2023. The award was granted for strengthening integration in the treatment of vulnerable citizens living with type 2 diabetes, as well as their relatives. The project was implemented by a partnership consisting of the Social Housing Master Plan in Tingbjerg and Utterslevhuse, the City of Copenhagen Centre for Diabetes and Heart Disease, and Steno Diabetes Center Copenhagen. The photo shows senior researcher Paul Bloch (second from the right) from Steno and others present at the award ceremony. Photo: Nils Meilvang





Inpatient diabetes treatment gets a boost: The Capital Region of Denmark's gastroenterology and neurology departments, as well as the Department of Medicine at Bornholm Hospital, are the initial target group for an initiative that will improve diabetes treatment when diabetic patients are admitted for reasons other than diabetes. It will establish e-learning materials and a network of diabetes ambassadors etc. It will also be possible to monitor those admitted with diabetes in Sundhedsplatformen (the Health Platform), and a method will be developed to gauge whether patients with diabetes are safe during admission. In addition, continuous glucose monitors (CGMs) are being pilot tested for patients admitted with type 2 diabetes in order to follow blood sugar levels. Both projects are supplementary treatment initiatives.

Department of Education

Communication and Skills Development

The goal of the department is to increase and strengthen the quality of both treatment and knowledge of diabetes among experts through study courses and knowledge communication etc.

2.862

people have attended
71 courses at Steno
during 2023



The Knowledge Centre has a new network: The Knowledge Centre for Diabetes has established a network for knowledge centres within health and social care. The purpose of the network is to facilitate knowledge sharing and skills development in unique methods that characterise the work in Denmark's knowledge centres. Steno has played host to two successful meetings that brought together 31 institutions and laid the foundation stone for future collaboration and mutual development within the sector.

Artificial intelligence utilised for knowledge of diabetes in Danish: The Danish Diabetes and Knowledge Center has intensively focused on exploiting the opportunities afforded by artificial intelligence (AI), particularly when processing vast quantities of text, to strengthen the centre's core roles: effective communication and research mapping. The centre has developed an AI superstructure for the specialised search function NemPubMed, which can summarise abstracts of scientific articles in easily understandable Danish. In addition, the Knowledge Centre for Diabetes is working to develop advanced chatbots, which can answer questions based on content from the videncenterfordiabetes.dk knowledge portal and Danish diabetes treatment guidelines.

Staff at care homes have been trained in caring for elderly people with diabetes: Elderly people with diabetes have been brought to the fore in the form of courses at Steno and care homes in the Capital Region of Denmark. The courses are continuously evaluated to ensure that the correct knowledge is communicated. Some of the key subjects are complications, medical treatment of diabetes in the elderly and also injection technique. The training employs several types of learning methods, including a procedure where staff live as though they had diabetes. Videos and graphic tools have also been developed. The need for training covering elderly people with diabetes has been so great that there are plans for health professionals who have attended the course to start teaching colleagues themselves.

Better use of data in general practice will improve treatment: Eighteen general practitioners in the Capital Region participated in a project (a supplementary treatment initiative) developed together with Quality in General Practice in the Capital Region. The initiative will increase the use of data among general practitioners in order to improve diabetes treatment. Preliminary data indicate that a focus on data in general practices improves the quality of treatment of people with type 2 diabetes and increases patient satisfaction.



Gentle start-up

Togetherness helps create motivation to exercise

Everyone can exercise. This is the mantra behind “Gentle start-up”, an exercise service at Steno for people with type 2 diabetes who experience complications and multimorbidities.

Julie Hagstrøm Danielsen is a sports physiologist and leads the service. She describes how adapting exercise so that it takes into consideration the individual’s physical aptitudes, wishes and needs is her vocation.

“There may be physical infirmities that make exercise difficult, but there can also be mental barriers. If the participants haven’t been used to exercising, they can really fear whether their body can tolerate breathlessness, for example. Thankfully, it can,” she reassures. Another important factor that is emphasised is the unity of the exercise teams, as this helps to create meaning and motivation.

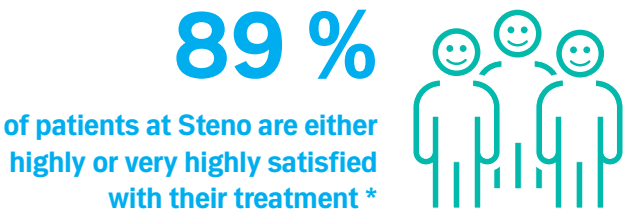
“People feel welcome once they recognise each other and have chatted together. A really positive mood develops among many of the teams – and one team even had a regular habit of drinking coffee together after exercising,” she says.



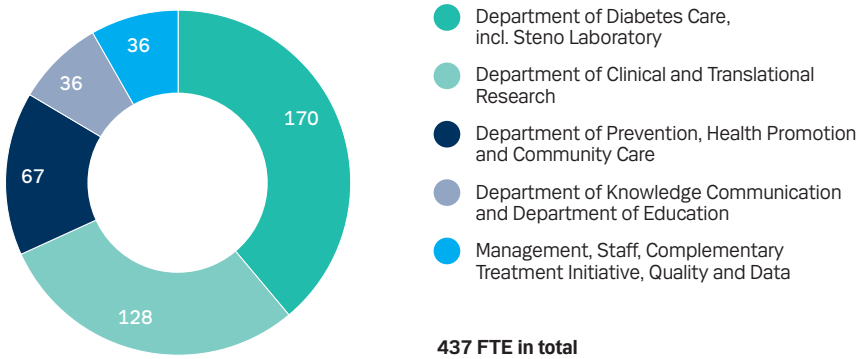


Operations

The Department of Diabetes Care is the largest at Steno, and users are highly satisfied with the treatment.



Employee breakdown by departments



Finances

Cost-based accounts

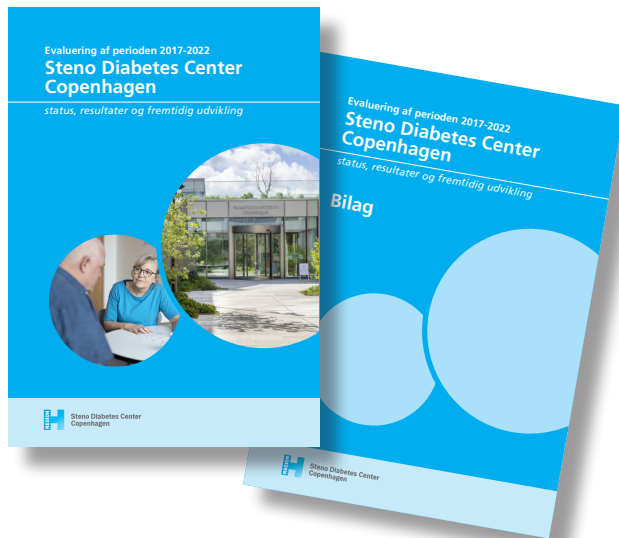
Million kroner	Budget 2023	Accounts 2023	Deviation
Regional framework	226,9	220,1	6,8
Grant from the Novo Nordisk Foundation	181,3	152,7	28,6

Financing from other external funding bodies *

Million kroner	Expenditure 2023	Grants 2023-2026	Of which new grants in 2023
Steno Diabetes Center Copenhagen in total	76,6	321,5	113,8

* There were 244 active external research projects at year-end

* Source: National survey conducted by all five Steno Diabetes Centers and the Centre for Patient Involvement. Find the report (in Danish) at videncenterfordiabetes.dk/tilfredshed



An evaluation of Steno Diabetes Center Copenhagen (SDCC) from 2017–2022 concludes:

- SDCC has been able to operate despite the major change process that the organisation has undergone, including conversion to a regional health service, increased patient volume from approx. 5,700 to approx. 11,000 and relocation to a new building in Herlev.
- Quality of treatment has been satisfactory in the adult area, while the children and adolescent area, which was first included at SDCC in November 2021, has not yet achieved a satisfactorily high level.
- The clinic at SDCC is generally good as regards patient satisfaction – compared with the region and country as a whole. Eighty-nine per cent of the patients at SDCC state that they are either highly or very highly satisfied with their treatment.
- A variety of value-creating collaborations have been established with other clinical specialties, including the renal, eye and orthopaedic surgery fields.
- The use of diabetes technology, such as sensors and pumps, is high at SDCC compared with the national average. This has ensured a good framework for creating knowledge on the beneficial use and effect of diabetes technology for the patients, but also at a national and international level.
- Employees from SDCC have significantly contributed to the national and international treatment guidelines.



Stenostemmer is a podcast series from 2023 in which Magnus T. Jensen talked with employees about their work. The series can be found on Spotify.





The Golden Apple is a newly established employee award. The bronze sculpture was created by artist Charlotte Tønder, and the first recipient of the award was economist Yvonne Birch Berthelsen (photo). The award will henceforth be presented each year on 5 November, Steno's birthday. The apple symbolises the holistic approach to diabetes treatment that was founded by Steno's first doctor, H.C. Hagedorn. He planted an apple orchard where patients could stroll and also pick and eat apples.

Awards

Numerous employees at Steno received prestigious national and international awards, honours, nominations and grants in 2023. Several are mentioned elsewhere in the report.

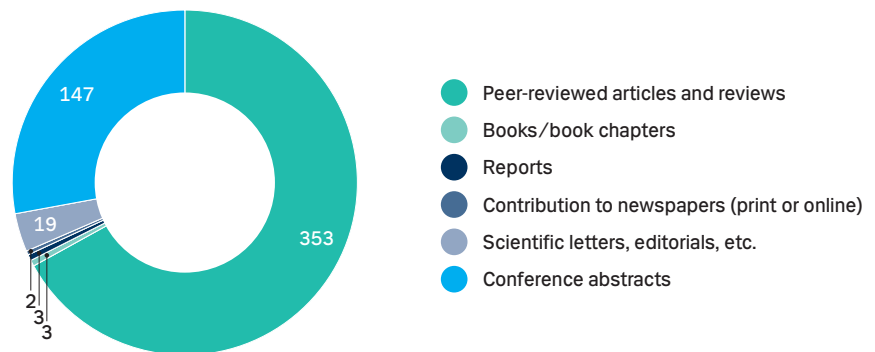
Leader of Complications Research, professor and consultant Peter Rossing, received the Danish Kidney Association's Renal Award for his and his research group's contribution to introducing new preventive treatment in chronic kidney disease.

CEO Magnus T. Jensen was also chosen as chairperson elect for the European Society of Cardiology. In addition, he was appointed professor of cardiology with special focus on cardiovascular disease at Copenhagen University and is the new chairperson of the Health Professions Council for Endocrinology in the Capital Region.

Scientific output

Steno's researchers have never published as many scientific articles as in 2023.

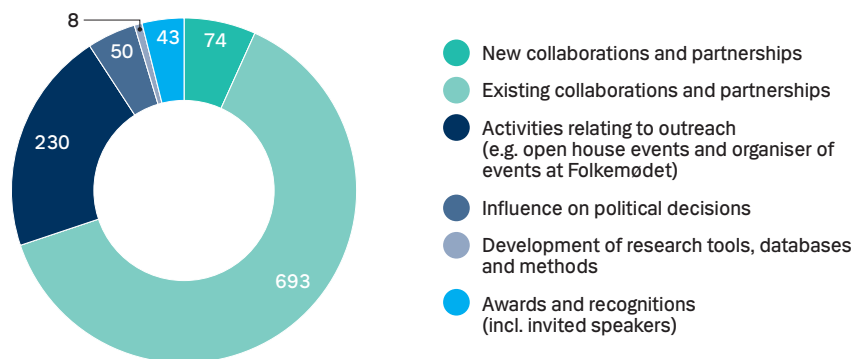
Number of publications in 2023 by type



Many of the published scientific articles were published in some of the most recognised journals. Three articles were published in The Lancet, considered to be the leading in-

ternational medical journal. Articles were also published in JAMA, Nature Medicine, Nature Biotechnology and Annals of Internal Medicine, among others.

Knowledge sharing and development activities in 2023





Heard
on the
hallways

“ I feel real peace of mind here

“I’ve been going to Steno for 19 years and hope that I can always come here rather than to my GP. Diabetes is not just diabetes, but many other conditions. I’ve now begun to suffer from neuropathy. My feet are really hypersensitive; just the duvet covering my feet causes pain. If I went to my GP, he wouldn’t think that it was connected with diabetes. But that’s what the doctors at Steno think, of course, because here you can have both your eyes and feet checked, and you can talk to a nutritionist. I feel real peace of mind here.”

“I’m also pleased that, at Steno, you finally get to see a psychologist. This is something I’ve wanted for

many, many years. A holistic view of diabetes is what’s required because your quality of life is really impaired when you have a chronic illness. I do believe that I’ve had diabetes stress, and I’m now seeing one of the psychologists – and they really know something about diabetes here. It’s not that much use seeing psychologists who don’t know anything about diabetes.”

*Henrik Lund Sørensen, aged 66.
He has had type 2 diabetes for 23 years.
Retired TV cameraman*



” I can see the development

“It’s been really nice to come here to Steno, not least because everything is all in one place. Sometimes, you might be satisfied with just a telephone conversation rather than meeting up. It works well for me if I just have to be here two to three times during the course of a year.

“It can take a bit of a while to get an appointment, though. I missed an appointment with a podiatrist once, and it was almost impossible to arrange a new appointment. It seems as though there’s a bit of old-fashioned hospital bureaucracy sometimes.

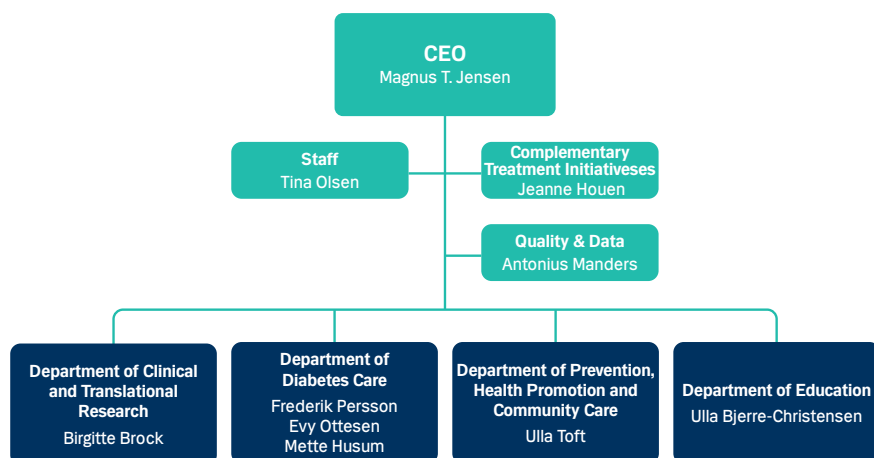
“But I think that will change. You can both see and feel how Steno is continuously developing in many

areas. The treatment is what’s most important, of course. For example, you can now have your eyes checked without having to put drops in them first, which stings. That’s a positive development, and things like that are developing all the time. There are also educational days and topic evenings here about new research and treatment, and I enjoy following these. It’s really great to keep updated about the latest knowledge.”

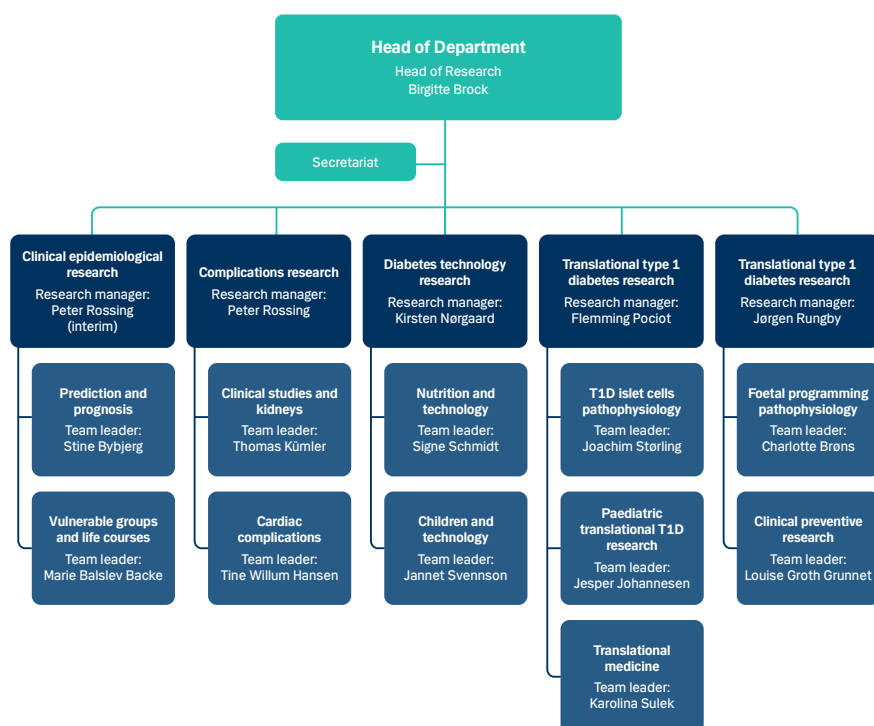
*Dorthe Kølander Hansen, aged 43.
She has had type 1 diabetes for 33 years.
Head of department at a care home*

Organisation

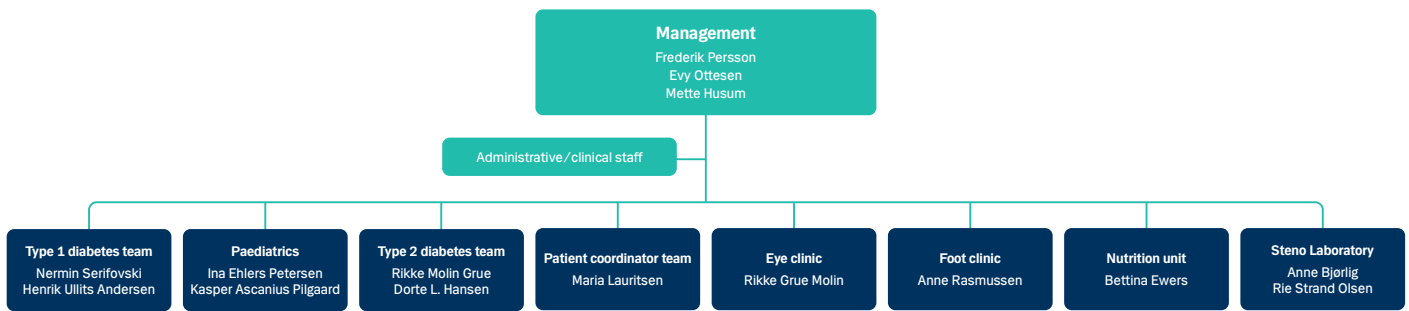
In the past year, Steno Diabetes Center Copenhagen has gone from five units to four departments and three support functions.



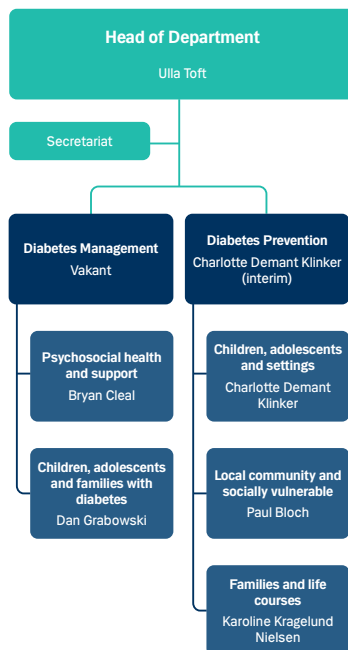
Department of Clinical and Translational Research



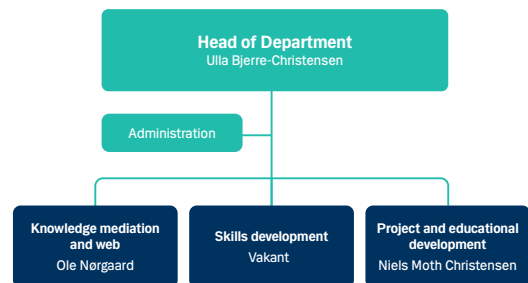
Department of Diabetes Care



Department of Prevention, Health Promotion and Community Care



Department of Education



Board of Directors

Erik Jylling (chair), group director in the Capital Region of Denmark

Anne Jastrup-Okkels, director at Herlev and Gentofte Hospital

Bente Stallknecht, dean at the Health Research Faculty at Copenhagen University

Per Bennetsen, managing director of the Health and Care Administration at the City of Copenhagen

Stig Sonne-Larsen, general practitioner

Martin Ridderstråle, senior vice president of the Novo Nordisk Foundation

Anne Rasmussen, lead podiatrist at Steno, employee representative

Sophie Hindkjær, appointed user representative

Christian Collin, appointed user representative





Diabetes in a multicultural context: Ninety-six people with type 2 diabetes and an ethnic minority background participated in a randomised, controlled study (a supplementary treatment initiative) to develop and test a treatment initiative that takes into consideration the special challenges faced by this group of patients. The objective is to improve blood sugar regulation, relatives' understanding of diabetes and to increase their skills at living with diabetes. The project is expected to conclude in 2025.

Quality indicators

Demography

Indicator	2023	2022	Target (DVDD)
Number of people with diabetes	10.665	10.332	
People with type 1 diabetes	5.811 (43,5%)	5.561 (53,8%)	
People with type 2 diabetes	4.243 (39,8%)	4.296 (41,6%)	
People with other types of diabetes	611 (5,7%)	475 (4,6%)	
Patient pathways (number, including telephone and video consultations)	52.927	50.462	
Gender distribution (number, % of all adults)			
Men	6.053 (86,8%)	5.976 (57,8%)	
Women	4.612 (43,2%)	4.356 (42,2%)	
Average age (years)	54,3	54,8	
Body mass index (kg/m²)			
People with type 1 diabetes	26,1	26,1	
People with type 2 diabetes	29,4	29,6	
Diabetes duration (median)*			
People with type 1 diabetes	21	21	
People with type 2 diabetes	17	17	

Lipids

Indicator	2023	2022	Target (DVDD)
Proportion of people over 30 years of age who have had their LDL cholesterol measured within the last 12 months (±3 months)			
People with type 1 diabetes	85,6%	84,8%	Min 95%
People with type 2 diabetes	91,7%	94,4%	Min 95%
Proportion of people with diabetes with LDL cholesterol ≤ 2.5 mmol/l			
People with type 1 diabetes	68,8%	68,5%	
People with type 2 diabetes	86,2%	84,1%	Min 90%
Proportion of people with diabetes over 40 years of age with LDL cholesterol > 2.5 who are not on lipid-lowering treatment (%)			
People with type 1 diabetes	51,5%	53,3%	
People with type 2 diabetes	32,6%	32,5%	
LDL-cholesterol (mmol/l)			
People with type 1 diabetes	2,3	2,3	
People with type 2 diabetes	1,7	1,8	

Metabolic or glycaemic regulation

Indicator	2023	2022	Target (DVDD)
Proportion of people with diabetes who have an HbA1c of ≤ 53 mmol/mol (%)			
People with type 1 diabetes	35,1%	33,6%	
People with type 2 diabetes	41,9%	41,6%	
Proportion of people with diabetes who have an HbA1c ≥ 70 mmol/mol (%)			
People with type 1 diabetes	19,5%	20,4%	Max 25%
People with type 2 diabetes	20,2%	19,4%	Max 25%
Proportion of people with type 2 diabetes with HbA1c ≥ 53 mmol/mol, who are not on antidiabetic treatment	1,00%	0,23%	Max 5%
Long-term haemoglobin – HbA1c (mmol/mol)			
People with type 1 diabetes	59,9	60,6	
People with type 2 diabetes	58,6	58,9	

Albuminuria

Indicator	2023	2022	Target (DVDD)
Proportion of people with diabetes who have been investigated for albuminuria within the last 12 months (±3 months)			
People with type 1 diabetes	85,8%	79,0%	
People with type 2 diabetes	91,9%	89,3%	
Proportion of people with diabetes with 1 U-albumin/creatinine measurement > 30, who are not on ACE inhibitors/ATII receptor antagonist treatment			
People with type 1 diabetes	34,8%	36,2%	Max. 20%
People with type 2 diabetes	21,7%	21,8%	Max. 20%

Eye investigation

Indicator	2023	2022	Target (DVDD)
Proportion of people with diabetes who have undergone eye screening within the last 4 years (%)			
People with type 1 diabetes	91,3%	91,4%	
People with type 2 diabetes	87,0%	85,9%	
Retinopathy (no)			
Retinopathy	NA	NA	
Maculopathy	NA	NA	
Blindness prevalence (%)	NA	NA	

Hypertension

Indicator	2023	2022	Target (DVDD)
Proportion of people with diabetes who have had their blood pressure measured within the last 12 months (±3 months)			
People with type 1 diabetes	94,1%	92,0%	Min 95%
People with type 2 diabetes	98,5%	98,0%	Min 95%
Proportion of people with diabetes with blood pressure ≤ 140/90			
People with type 1 diabetes	72,1%	72,0%	Min 85%
People with type 2 diabetes	63,6%	64,1%	Min 85%
Proportion of people with diabetes with blood pressure ≤ 140/90 who are not on antihypertensive treatment (%)			
People with type 1 diabetes	49,6%	47,4%	
People with type 2 diabetes	26,0%	22,0%	
Proportion of people with diabetes on antihypertensive treatment (%)			
People with type 1 diabetes	32,3%	34,0%	
People with type 2 diabetes	71,1%	72,9%	
Blood pressure (systolic/diastolic – mmHg)			
People with type 1 diabetes	130 / 77	130 / 78	
People with type 2 diabetes	133 / 76	134 / 77	

Comments: NA = No available data.

All data obtained from Sundhedsplatformen.
DVDD: Dansk Voksen Diabetes Database.

Foot investigation

Indicator	Value 2023	Value 2022	Target (DVDD)
Proportion of people with diabetes who have undergone foot screening within the last 12 months ($\pm$ 3 months) (%)			
People with type 1 diabetes	73,6%	64,1%	
People with type 2 diabetes	83,5%	80,9%	
Proportion of people with diabetes with an amputation within the last 12 months ($\pm$3 months)	0,41%	0,55%	

Smoking

Indicator	Value 2023	Value 2022	Target (DVDD)
Proportion of daily smokers (%)			
People with type 1 diabetes	15,1%	14,8%	
People with type 2 diabetes	15,7%	15,7%	

Demography

Indicator	2023	2022	Target (DVDD)
Number of children with diabetes (number)			
Children with type 1 diabetes	843	805	
Children with type 2 diabetes	15	10	
Children with other types of diabetes	57	49	
Patient pathways (number of appointments performed, incl. telephone and video consultations, excl. appointments with bioanalysts)	3.862	3.775	
Gender distribution (number, % of all adults)			
Boys	467	433	
Girls	448	431	
Average age (years)	12,3	12,2	
Body mass index (kg/m²)	20,3	20,9	
Diabetes duration (median)	5	5	

Albuminuria

Indicator	2023	2022	Target (DVDD)
Proportion of children with diabetes who were investigated for urine albuminuria according to applicable guidelines (on reaching 14, 17 years)	87,3%	89,7%	Min 95%

Eye investigation

Indicator	2023	2022	Target (DVDD)
Proportion of children with diabetes who have undergone eye screening within the last 36 months (on reaching 14 and 17 years of age) (%)	73,9%	79,7%	Min 80%
Retinopathy			
Proportion of screened patients with diabetes where no retinopathy changes were observed	NA	NA	
Prevalence of the different degrees of retinopathy (0, 1, 2, 3, 4) and maculopathy (yes/no)	NA	NA	

Metabolic or glycaemic regulation

Indicator	2023	2022	Target (DVDD)
Proportion of children with type 1 diabetes who have an HbA1c of $\leq$ 53 mmol/mol (%)	47,3%	45,0%	Min 40%
Proportion of children with type 1 diabetes who have an HbA1c $\geq$ 70 mmol/mol (%)	11,6%	12,5%	Less than 20%
Long-term haemoglobin – HbA1c average (mmol/mol)	56,5	59,4	

Hypertension

Indicator	2023	2022	Target (DVDD)
Proportion of children with diabetes who have their blood pressure measured at least once a year	49,4%	52,3%	
Blood pressure (systolic/diastolic – mmHg)			
Children with type 1 diabetes	111/68	112/68	

Other

Indicator	2023	2022	Target (DVDD)
Proportion of newly diagnosed children who were screened for coeliac disease up to 1 year after diagnosis	81,8%	78,6%	
Proportion of newly diagnosed children who have a TSH test for metabolic disease up to 1 year after diagnosis	89,1%	92,1%	
Proportion of children who have a BMIs over plus 2	15,9%	13,8%	

Comments: NA = No available data.
 All data obtained from Sundhedsplatformen.
 DVDD: Dansk Voksne Diabetes Database



A multimedia study was commenced in December and will function both as a sound and film study to record digital courses, podcasts, films, etc. for social media.

Editing

Journalist Helen H. Heidemann

Design and layout

Graphic designer, MD, Morten Petersen, ReflektDesign

Images

Photo journalist Lizette Kabré, unless otherwise named

Printing

Frederiksberg Bogtrykkeri A/S

March 2024



Steno Diabetes Center Copenhagen

Borgmester Ib Juuls Vej 83
DK-2730 Herlev

Telephone: 39 68 08 00
Email: sdcc-fp-stenoinfo@regionh.dk
www.sdcc.dk