

cachet

Copenhagen  
Center for  
Health Technology 

**CACHET**  
in profile  
**2018**



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**Photos:** Torben Nielsen and Jesper Rais



# Welcome

The Copenhagen Centre for Health Technology (CACHET) is an interdisciplinary research center with a vision to promote and support healthy living, active ageing and chronic disease prevention and management through Personalised health technology. CACHET is inaugurated as a strategic partnership between the Capital Region of Denmark, the City of Copenhagen, the Faculty of Health and Medical Sciences at the University of Copenhagen and the Technical University of Denmark.

## Excellent research

CACHET hosts and initiates a wide range of interdisciplinary research projects at the intersection of the technical and medical sciences, taking their outset in specific healthcare challenges in the Danish society. By coupling a user-centered research and innovation process with solid academic knowledge, the research focuses on application and impact.

## Research training

The CACHET PhD programme funds and trains the health technology researchers of the future. Our competitive PhD programme is designed to foster problem-oriented, interdisciplinary and entrepreneurial research. Be it in academia, industry, society in general or in the clinic, these researchers will be the frontrunners in developing the technology-based healthcare model of the future.

## Industrial innovation

Most of CACHET's research is done with our 23 industrial partners. There is a strong focus on translating research into new technologies and products for commercial growth in the Danish life science industry. The CACHET innovation programme helps companies to work with top-class researchers in a flexible and pragmatic way.

## Societal and healthcare innovation

By addressing major health challenges in the Danish society, CACHET research starts and ends with societal innovation. CACHET works to translate research into new technologies and healthcare services for the benefit of patients and the Danish healthcare system.

This small book is made in order to provide an overview and status of the research, training and innovation of CACHET as it were at the end of 2017.

Enjoy the reading.



Jakob E. Bardram, MSc, PhD  
Director, Professor

**"CACHET** will support and promote healthy living, active ageing and chronic disease prevention and management through the design, development, evaluation and implementation of personalised health technology"



2015

**CACHET opening**

October, 2015

**Personal Health Technologies**

Inaugural lecture

**CACHET RESEARCH SEMINAR 1**

Research ideas

2016

**CACHET RESEARCH SEMINAR 2**

Dementia, diabetes prevention

**Training**

**CACHET PHD SEMINAR**

**Seminar**

Mobile mental health monitoring

**Training**

Empirical research in Interactive systems  
PhD course

**Exhibition**

Medico bazar '16

**TIMELINE OF ACTIVITIES 2015, 2016 AND 2017**

CACHET RESEARCH PROJECTS

REACH

RADMIS

FUNDING PHD ROUND 1



FUNDING PHD ROUND 2



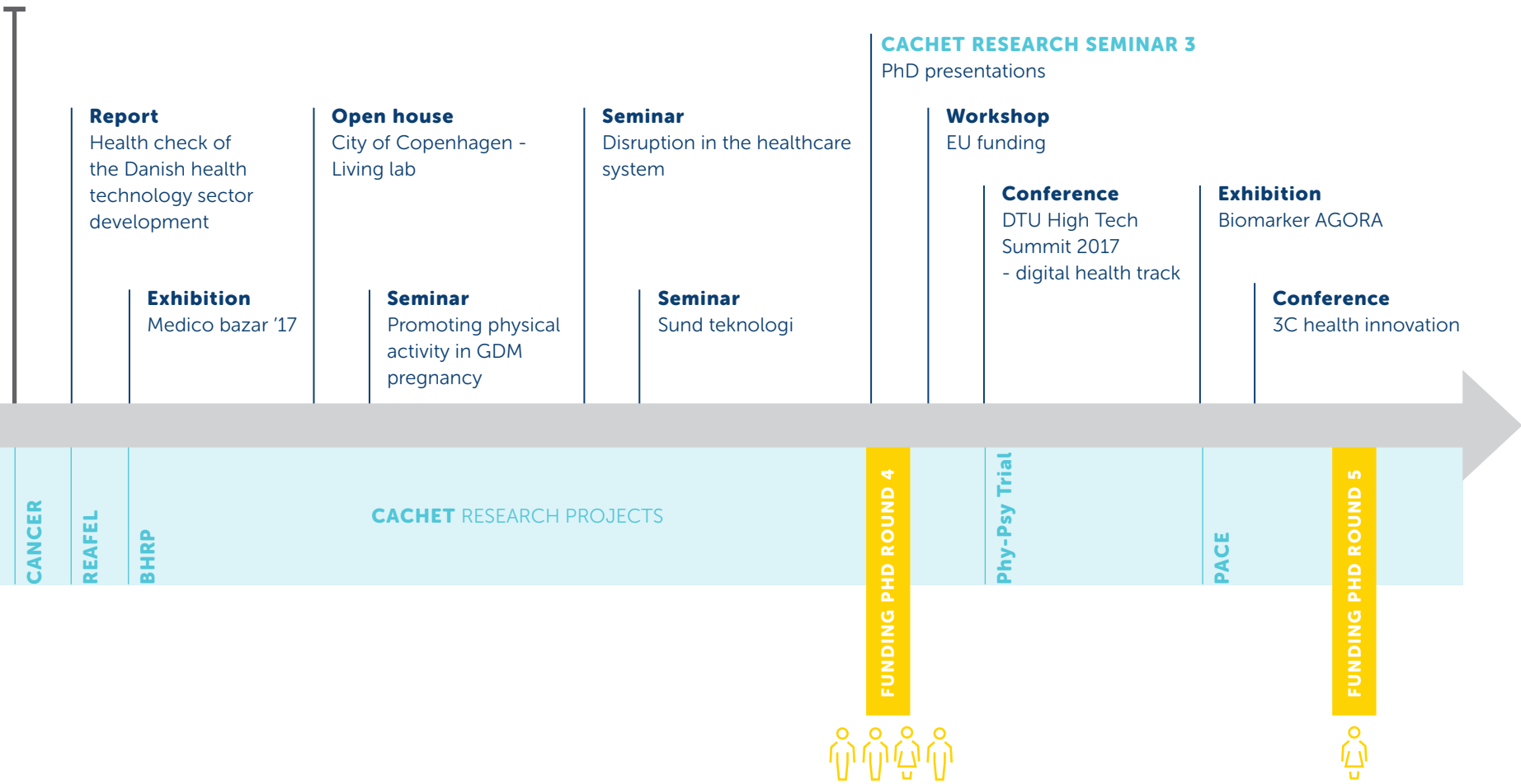
CHS

FUNDING PHD ROUND 3



TEAM

GO-ACTIVE



# Research

CACHET research is characterised by depth, innovation and impact. CACHET initiates, co-funds, hosts and affiliates with a wide range of different research projects in a cross-disciplinary research ecology that involves technology and medical researchers, clinicians and healthcare personnel.

From a health perspective, CACHET dedicates focus to a core set of healthcare challenges of chronic disease management, preventive health, regulatory demands and outcome-based healthcare business models. From a technological perspective, the research focuses on developing personalised technologies, digitalization of healthcare solutions, wearable sensor technology and big data analysis.

CACHET projects are characterised by being:

- focused on the design, development and evaluation of personalised health technology
- interdisciplinary across the medical and technical sciences
- application-focused and grounded in end-user organisations. (like nursing homes or hospitals)
- innovative by developing new solutions for the Danish healthcare system and new products and services for the life science companies.

## Translational research

Technology transfer and health innovation based on research results are core to CACHET. We collaborate extensively with industrial companies and public health partners to move research, innovation and discoveries into use by clinicians, healthcare professionals, patients and citizens.

The next two pages describe two CACHET research projects – one using advanced monitoring and big data algorithms to detect mortality after cancer surgery and one aiming to reduce the excess mortality of people with severe mental illness. These projects illustrate the depth of the research done, the interdisciplinary nature of the research and the potential impact of the research in terms of improving life for chronic patients and savings in the healthcare system.

### Research challenges and opportunities

CACHET research is addressing a set of core healthcare challenges by exploiting emerging technological opportunities within personalised and digitalised health.

**90+**  
Researchers

affiliated with CACHET



**27**  
PhD students  
affiliated with CACHET



**163**  
Publications  
in 2016-17





## Healthcare Challenges



### Chronic disease management

Accounting for 2/3 of all healthcare spend worldwide – and increasing – chronic disease management is and will be the main focus of health



### Preventive and predictive health

Obesity, lack of physical activity and unhealthy lifestyle are the major factors of health problems and need to be addressed early



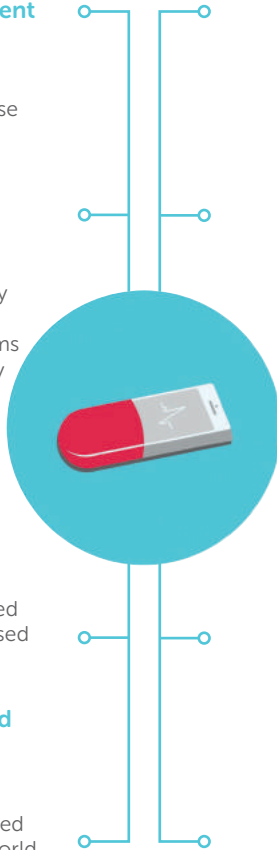
### Regulatory

Legal and regulatory demands for protecting patient privacy, data- and safety will be enforced heavily as digital and personalised health emerge



### Evidence & outcome-based health

New business models both for suppliers and vendors will be tied to clinical evidence and real-world patient outcome (efficiency)



## Technology Opportunities

### Personalised technology



Engaging, patient-centric- and participatory technology can deliver interventions tailored to the individual and sustain engagement “beyond-the-pill” outside traditional care settings

### Digitalisation



The ubiquity of digital health and communication technology drives new models for virtual and semi-automated doctor-patient contact

### Health IoT



Pervasive, mobile and wearable technology for sensing and engaging with patients creates a unique platform for personalised health delivery

### Big data analytics



Computing power and advanced analytics and learning algorithms drive insight and prediction of patient behaviour, treatment- and care costs



### Gaze-controlled robots

Gaze tracking affords fast, precise and durable input for communication, mobility and smart home control. The GazeIT project develops gaze-controlled robots for people with motor disabilities.

## Case: Detection of mortality after cancer surgery

Major elective cancer surgery in the abdomen is associated with substantial morbidity and mortality risk despite optimised anaesthesia and surgical techniques. This is due to late detection of severe complications and late treatment when the condition has progressed to the point of no return. All Danish hospitals currently use an Early Warning Score (EWS) system, where a number of physiological parameters are recorded once every 12 hours. However, no proven survival benefit of this approach has been shown.

The goal of this project is to develop and evaluate a continuous (24/7) system for detecting patterns prior to serious post-surgical events. This would be superior to the current EWS, and preventive interventions can be initiated before the patient suffers life-threatening injury. The goal is to design a system for wireless home monitoring to ensure 24/7 monitoring and analysis of data from patients in the first critical weeks after discharge from hospital, also to reduce the risks associated with cancer surgery.

The project aims to considerably reduce the risks associated with abdominal cancer surgery and emergency medical conditions, such as exacerbation of chronic obstructive pulmonary disease, and consequently injury and healthcare expenses.



### Primary Investigators:

**Helge B. D. Sørensen**, Associate Professor, DTU Elektro.

**Christian S. Meyhoff**, Chief Physician, Dept. of Anaesthesia and Intensive Care, Bispebjerg and Frederiksberg Hospital.

**Eske K. Aasvang**, Senior Registrar, Dept. of Anesthesiology, Rigshospitalet.

**Funding:** The Danish Cancer Society, The A.P. Møller Foundation, Frederiksberg and Bispebjerg Hospital, Rigshospitalet, DTU Elektro and CACHET.

### Facts

- Severe morbidity occurs in 25-35% after abdominal cancer surgery within the first 30 days.
- Only 5% of the serious cases of severe hypoxia are captured with existing 12-hour routine checks.





## Case: Improving treatment of comorbid physical conditions in patients with severe mental illness

In general, people with severe mental illness (SMI) die 10-20 years earlier. Most of this excess mortality stems from physical diseases, which are underdiagnosed and undertreated. These patients are treated across sector borders, and coordinated care between general practice (GP), municipalities and hospital psychiatry is imperative.

The Phy-Psy Trial will develop, execute and test an intervention, which aims to reduce the excess mortality of people with SMI. The intervention will be a coordinated care model supported by an information and communication technology (ICT) platform. This integrated care platform helps collect core health parameters and patient reported outcome data from patients while supporting coordination and communication across the healthcare providers involved in the treatment and care of the patient.

The model will rely on cross-sectorial collaboration based on a coordinated care-plan tailored to the needs of the patient. A co-design approach will involve patients, their relatives and professionals in general practice, municipalities and psychiatry to ensure development of a realistic and sustainable model that makes sense for all involved users. The care model will be tested in a randomised controlled parallel-group trial.

The care model will positively impact on GPs', psychiatrists' and social workers' possibilities of improving the overall care of SMI patients. This will reduce patients' excess mortality, costs of medications, severe side effects of medications, re-admissions to psychiatric ward, and it will extend life expectancy, strengthen patients' participation in and adherence to effective treatment of comorbid physical diseases and improve patients' quality of life.

### Primary investigators:

**Susanne Reventlow**, Professor, Dept. of Public Health, UCPH. **Niels de Fine Olivarius**, Professor, Dept. of Public Health, UCPH. **Flemming Bro**, Professor, Dept. of Public Health, Aarhus University. **Jakob E. Bardram**, Professor, DTU Compute. **Merete Nordentoft**, Professor, Mental Health Services, CRDK. **Pia Kürstein Kjellberg**, Head of Research, Danish Centre of Applied Social Science, VIVE. **John Brodersen**, Professor, Dept. of Public Health, UCPH. **Annette Sofie Davidsen**, Associate Professor, Dept. of Public Health, UCPH. **Mikkel Bring Christensen**, Clinical Associate Professor, Dept. of Clinical Pharmacology, Bispebjerg and Frederiksberg Hospital

**Funding:** Novo Nordisk Foundation

## Facts

- SMI affects 2% of the Danish population.
- The project will recruit 4.000 Danish citizens with SMI, aged 18-65.

# Research training

The CACHET PhD programme is a unique interdisciplinary research training programme for early stage researchers. The goal is to train and educate a new cohort of young researchers who will become the thought leaders of the future transformation of a technology-based healthcare system.

Besides funding, the CACHET PhD programme offers interdisciplinary supervision to ensure that each student has both a technical and a clinical supervisor. It offers a user-centered and problem-oriented research project that is anchored in either a hospital clinic or the Health and Care Administration in the City of Copenhagen, and it ensures focus on industrial innovation and product development.

Currently, CACHET PhD students work on a wide range of exciting topics like:

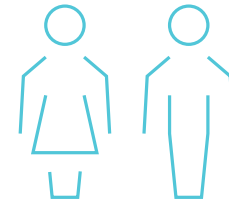
- Tracking lifestyle behaviour from wearable and mobile technology
- Smartphone-based cognitive-behavioural therapy for depressive patients
- Personalising hearing care
- Brain-computer interfaces for neurorehabilitation of post-stroke patients
- Mobile technology for asthma treatment in children
- Methodology for establishing biological age
- Biochip for diagnosis of thyroid gland disorders

In total, 27 PhD students are affiliated with CACHET; of these, half (14) are funded by CACHET. A complete list of CACHET PhD students and their projects can be found on page 32.

27

PhD students

affiliated with CACHET



16 at DTU

11 at UCPH

14

Funded  
by CACHET





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## SMARTPHONE-BASED ELECTRONIC MONITORING OF PATIENTS WITH BIPOLAR DISORDER

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**PhD student:** Sharleny Stanislaus  
**Partners:** Mental Health Services (CRDK), DTU Compute, UCPH and Monsenso

Bipolar disorder is a severe mental illness with frequent depressive and manic episodes. Alterations in behavioural activities during depression and mania are central and observable features in bipolar disorder. Data collection using smartphones provide a unique platform for monitoring behavioural indicators of depression and mania and offers options for early intervention and better care.

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## REHABILITATION OF POST-STROKE PATIENTS USING BRAIN-COMPUTER INTERFACING

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**PhD student:** Jakob Møller  
**Partners:** DTU Elektro and Rigshospitalet

Inefficient rehabilitation of post-stroke patients is a huge burden for both patients and society in terms of caretaker costs, lost productivity and quality of life. Worldwide, 15 million people suffer a stroke on a yearly basis. Of the survivors, 50% suffer from chronic loss of function even after rehabilitation. The project aims to utilize advances in brain-computer interfacing and functional electrical stimulation to develop an effective system for rehabilitation of fine hand motor functions in post-stroke patients.

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## EHEALTH SOLUTIONS FOR MINORS WITH CHRONIC DISEASES

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**PhD student:** Claudia Bagge-Petersen  
**Partners:** Dept. of Public Health (UCPH), Frederiksberg and Bispebjerg Hospital, DTU Compute, Telemedical Knowledge Center (CRDK), Danish Haemophilia Society and Foreningen af Unge med Gigt

Despite numerous evaluations of eHealth solutions developed to support minors in disease management, evidence on their effectiveness is far from conclusive. The project will generate knowledge about what makes minors a special group for using eHealth technologies in everyday disease management in order to advance future eHealth development and application. Through a techno-anthropological research approach, the research will pay attention to the correspondence, opportunities and contentions that might exist between home-grown illness management practices and those enabled by eHealth solutions.

# Innovation in society

Translational research and innovation in healthcare and society for the benefits of patients and citizens are the starting and ending points in CACHET.

## User-centered and participatory research design

The design, development and implementation of personal health technology take as a point of departure a deep understanding of patients' and citizens' everyday life and what it means to live with a disease. In the Phy-Psy Trial, ethnographic, clinical, public health and technical researchers work closely with patients in a participatory co-design process of novel treatment pathways and technology for shared care.

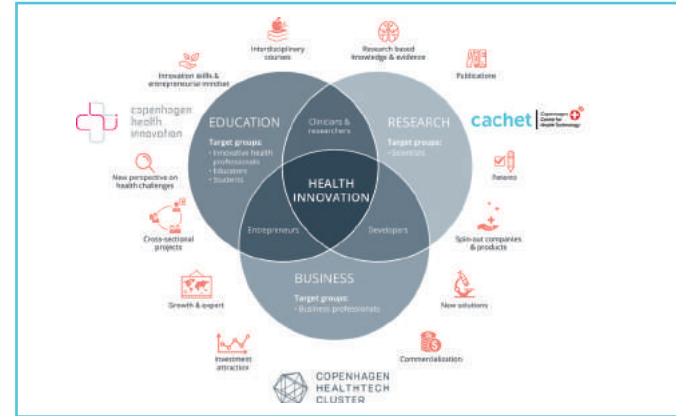
## Societal impact

The core health research topics of CACHET are centered on prevention, treatment and self-management of chronic diseases like diabetes, cardiovascular diseases, dementia and mental illness. Chronic diseases now account for two-thirds of the Danish healthcare costs, and, according to WHO, chronic diseases make up the largest burden of disease. Most CACHET projects address these societal challenges. In the RADMIS project seeks to reduce re-hospitalisation of depressive patients by 50%, potentially saving more than DKK 100 million in Greater Copenhagen.

## Better treatment and quality of life for patients

In the end, a core value of CACHET research is the impact on better patient treatment, more effective prevention and improved quality of life for patients and citizens. In the REAFEL project seeks to utilize a modern electrocardiogram (ECG) monitor for prevention of strokes. This solution can potentially prevent strokes for up to 600 patients in Greater Copenhagen alone.





## Greater Copenhagen Health Innovation

CACHET is part of the Greater Copenhagen Health Innovation ecosystem:

**CHC** - Copenhagen Healthtech Cluster focuses on supporting companies and commercial growth in the health technology industry.

**CHI** - Copenhagen Health Innovation focuses on developing competences and education in healthcare innovation.

**CACHET** - focuses on building a strong research base for health technology development and for establishing clinical evidence.

## Case: Developing personalised interventions to promote healthy behaviour for the elderly

**Partners:** Movesca, Dept. of Public Health (UCPH), Dragør Municipality and Copenhagen Healthtech Cluster

**Funding:** EU Regional Fund and the Capital Region of Denmark.

The collaboration between the company Movesca and researchers at CopenRehab at the Department of Public Health at UCPH aims to investigate how theories of motivational archetypes for behaviour change can be used to improve healthy behaviour such as physical activity.

### Personalising motivation to be physically active

Physical activity is considered a cornerstone in rehabilitation of citizens with lifestyle-related illnesses. However, beneficial effects of physical activity are challenged by low adherence rates. Motivation plays a central role in changing and sustaining healthier behaviour. People are motivated in different ways, hence the need for a tailored and personalised approach to motivate individuals.

### Co-creating an individualised approach

The project comprises a qualitative study of elderly citizens engaged in a municipal rehabilitation programme. Specifically, Movesca offers an IT-based solution for health profes-



The “5 Motivation-  
al Types” model  
developed to test  
and evaluate  
behaviour change

sionals to identify different motivational orientations. This solution will be co-designed between company, patients, municipality and researchers with the intention to create a solution that is useful for all stakeholders while researchers test and evaluate the application of relevant behaviour change methods, such as the model of “5 Motivational Types” developed in the CopenRehab research group.

### Attaining healthy behaviour for the elderly

The project aims at developing a screening tool for health professionals to facilitate tailored and personalised motivation. Such a tool will become a product to be offered to municipalities nationally for the benefit of healthcare services and patients. From a research perspective, the project will serve as a means to test, evaluate and improve a co-creation approach to design for behaviour change.





## Case: Monitoring physical activity

**Partners:** Dept. of Biomedical Sciences (UCPH) and DTU  
**Compute Funding:** Trygfonden

Physical activity is core to maintaining a healthy life style and to preventing and rehabilitating chronic diseases. Sustaining an active and healthy lifestyle in everyday routines is, however, challenging. Moreover, getting accurate insight into the level of activity of a person is technically challenging. This project has two purposes: (i) to accurately monitor physical activity during everyday life and (ii) to build and clinically verify a novel smartphone-based method for accurate estimation of energy expenditure.

### Understanding weight loss behaviour

The project has subjected 130 randomised, physically inactive, overweight and obese women and men to either 6 months of habitual lifestyle, active commuting or leisure-time exercise of moderate or vigorous intensity. Amongst other things, this study showed that inactive, overweight people can lose fat mass just as effectively by riding a bike to work as by exercising in their leisure time.

### Smartphones to monitor and analyse activity and energy expenditure

Participants were monitored by smartphone technology, double-labelled water, accelerometers and heart rate monitors. This data is being used to validate smartphones as a tech-

nology for monitoring and estimating energy expenditure in different domains of everyday life and determine the effectiveness of a structured exercise intervention to increase energy expenditure. Creating a smartphone-based method for accurately estimating energy expenditure and activity levels will be a significant simplification to the current laboratory-based approach of using double-marked water.

### Perspectives in the design and promotion of technologies for physical motivation

The results provide insights into the behavioural response of overweight citizens to various exercise programmes and inform the design of future health promotion efforts, including technology-based solutions for physical activity monitoring.

## Facts

- The project is part of the GO-ACTIWE project.
- The interdisciplinary study design and results of GO-ACTIWE have been published in Contemporary Clinical Trials and the International Journal of Obesity.
- The researchers have supported the Danish Council on Ethics in the preparation of teaching material on wearables, health and big data targeting upper secondary school.

# Supporting industry

Industrial innovation and commercial growth for life science companies in Greater Copenhagen are core parts of CACHET's activities. CACHET fosters research-based innovation by establishing tight collaborations between researchers and the industry. Two-thirds of all CACHET research projects involve one or more industrial partners.

## Collaborations at different stages of technology development and evaluation

To accommodate the needs of industry, collaborations range from technology development, feasibility testing and evaluation to clinical trials and studies to establish health evidence for the technology. For example, CACHET participates in 5 projects funded by Innovation Fund Denmark in which both technical, health professional and clinical researchers work closely with industry over longer periods of time to make research and commercial innovation go hand in hand.

## Supporting innovation in small and medium-sized enterprises

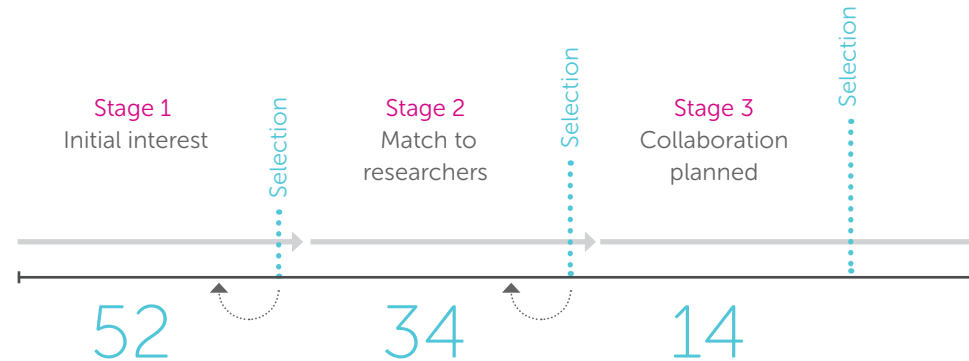
Through the Copenhagen Healthtech Solutions (CHS) programme, CACHET can initiate up to 24 collaborative projects involving researchers, small and medium-sized enterprises (SME), municipalities and other healthcare centres. The aim

of the CHS programme is to support growth in SMEs. The programme serves as an opportunity for researchers and industry to engage in collaborations that allow the pursuit of innovation possibilities in a quick way and serves as a foundation for more intensive and extensive long-term partnerships.

## Part of a Greater Copenhagen health innovation ecosystem

As part of the CHS programme, CACHET works closely with Copenhagen Healthtech Cluster (CHC) who handles the overall project management and recruits the participating SMEs. The programme is supported by the EU Regional Fund and the Capital Region of Denmark.

### Stages of the CHS programme – status of involved companies, December 2017:



The CHS programme aims to initiate 24 collaborations by Q3 2018 (stage 4)

Stage 4

Collaboration started

7

24

PhD student Benjamin Johansen works closely with the Danish hearing aid company Oticon to help personalise and adapt the user's hearing experience to the mobile context. This is done by integrating the hearing aid with the user's smartphone.



## Case: Innovating patient adherence technology

**Partners:** Drugstars, DTU Compute and Copenhagen Health-tech Cluster. **Funding:** EU Regional Fund and the Capital Region of Denmark.

Lack of adherence to prescribed medication treatment is a significant problem in most medical treatment. This causes both poor treatment and quality of life for patients. The reasons for lack of patient adherence are many and complex. The Danish start-up company Drugstars has developed an app to improve medication adherence, and this project seeks to improve this app by studying how users with different medicine prescriptions use the app and feel about their treatments.

### Investigating and understanding lack of patient adherence to treatments

The collaboration between Drugstars and DTU Compute aims at improving the value of the Drugstars app to individual users and of the collected patient data for healthcare companies and partners. By applying well-known and tested statistical methods to a new field, the project will test clinical usability of patient-derived information about medicine adherence retrieved from smartphone apps. Further, the project will develop specific models for integrating analysis results to improve patient engagement and, ultimately, adherence to medicine treatments.

### Evaluating usage patterns and feelings about medicine consumption

The project involves a longitudinal study of 955 people with type 1 and 2 diabetes using the Drugstars app and answering validated questions about the effects of treatments and related disease experience, attitudes and behaviours over a two-month period. Collected data are analysed by the company and involve researchers to determine correlations and intervention effects and are used for building predictive models.

### Developing personalised treatment and interaction through data patterns

Analysing user behaviour could lead to application of statistical experimental design methodologies when developing future app versions. These methods can test and evaluate various app modifications systematically, ultimately leading to personalised features and interactions.



### Patient engagement and adherence through positive feedback

The Drugstars app provides positive motivation and medication reminders to help users follow their medical treatment. Users earn stars by using and reviewing their medicines and donate their stars to patient organisations of their choice. The stars are then converted into actual monetary donations by Drugstars.



## Case: Reducing readmission of patients with depression or bipolar disorder

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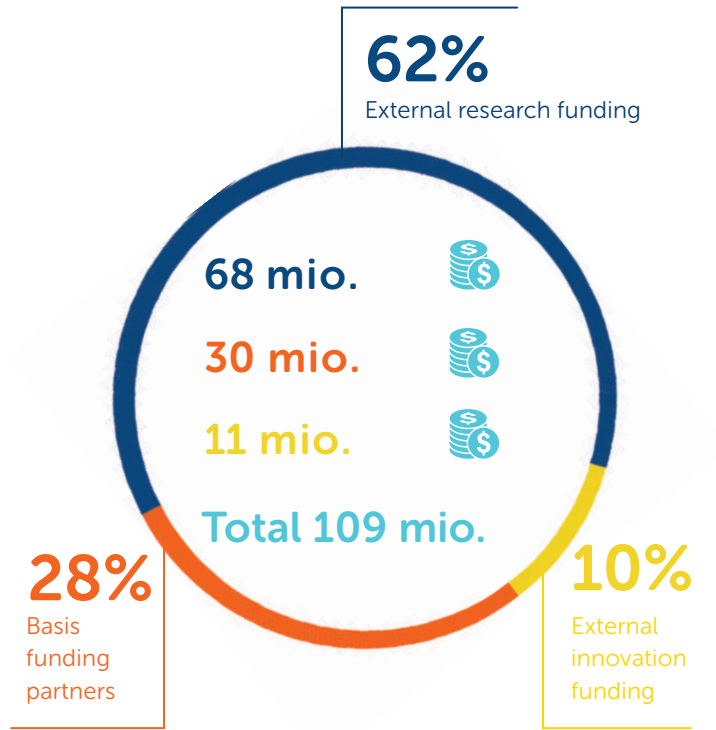
**Partners:** Mental Health Services (CRDK), DTU Compute and Monsenso. **Funding:** Innovation Fund Denmark

Depression and bipolar disorder impose a very high societal burden in terms of cost, lost productivity, morbidity, suffering and mortality. Patients with depression or bipolar disorder are more frequently hospitalised than any other psychiatric patient group, being responsible for 20% of all psychiatric hospitalisations. This project will design, develop, and provide clinical evidence for the use of a smartphone-based monitoring and intervention technology, which has the potential to reduce the rate of readmission by 50% and improve health outcome, quality of life, and empowerment for patients with depression or bipolar disorder.

- 2/3 of all costs in psychiatry is related to hospitalisation, and is estimated to 648 MDKK annually in Denmark
- the aim of RADMIS is to reduce the rate of re-admission by 50%
- the Monsenso system is an intelligent monitoring and treatment platform for mental health

# Project funding

CACHET research and innovation projects are funded by a variety of private, national and international foundations and initiatives.



# ново nordisk fonden



**TrygFonden**



Danish Cancer Society

**FWF**

Der Wissenschaftsfonds.

**BEVICA**

FONDEN

THE EUROPEAN UNION



The European Regional Development Fund

Investing in your future



# Research projects

**GO-ACTIVE** Motivating Physical Activity,  
2013-2018 **Funding:** Trygfonden

**MONARCA II** Monitoring and Predicting Illness Activity in  
Bipolar Disorder,  
2015-2018 **Funding:** The Capital Region of Denmark

**CHS** Copenhagen Healthtech Solutions,  
2016-2019 **Funding:** EU Regional Fund

**GazeIT** Accessibility by Gaze Tracking,  
2016-2019 **Funding:** Bevica Foundation

**REACH** Responsive Engagement of the Elderly,  
2016-2020 **Funding:** EU Horizon 2020

**TEAM** Technology Enabled Mental Health for Young People,  
2016-2020 **Funding:** EU Horizon 2020

**RADMIS** Reducing the Rate and Duration of Readmission  
Among Patients With Unipolar and Bipolar Disorder,  
2016-2020 **Funding:** Innovation Fund Denmark

**CANCER** Detection of Mortality After Cancer Surgery,  
2017-2020 **Funding:** The Danish Cancer Society,  
The A.P. Møller Foundation

**BHRP** Biometric Healthcare Research Platform,  
2017-2021 **Funding:** Innovation Fund Denmark

**PACE** Proactive Care for the Elderly with Dementia,  
2017-2021 **Funding:** Innovation Fund Denmark

**REAFEL** Reaching the Frail Elderly,  
2017-2021 **Funding:** Innovation Fund Denmark

**Phy-Psy Trial** A cluster randomised, parallel-group, 5-year  
trial of coordinated, co-produced care to reduce the excess  
mortality of patients with severe mental illness by improving  
the treatment of their comorbid physical conditions,  
2017-2024 **Funding:** Novo Nordisk Foundation

For more information about CACHET research projects  
and opportunities or collaboration, please visit  
[www.cachet.dk](http://www.cachet.dk)

# Partners

CACHET collaborates with a range of different research institutions, public institutions, private companies and organisations.

## Private companies



Kullegaard



Medtronic

MOVESCA

neurescue



PHILIPS  
Healthcare



TRIFORK.  
...think software



Research  
institutions



AALBORG UNIVERSITY  
COPENHAGEN



Gillberg Neuropsychiatry Centre  
Sahlgrenska Academy



Psykatri



Organisations



COPENHAGEN  
HEALTHTECH  
CLUSTER



copenhagen  
health  
innovation

COPENHAGEN  
EU OFFICE

DTU Business  
Executive School of Business



MedTech  
Innovation



Danish  
Haemophilia  
Society

Municipalities  
and public sector



Dragør  
KOMMUNE



HILLERØD  
KOMMUNE



LYNGBY-TAARBÆK  
KOMMUNE



/ihTek  
/idcenter for hjælpemidler og  
rehabilitations teknologi

# Events

Since 2015, CACHET has co-organised and hosted more than 20 seminars, conferences and workshops such as:

## CACHET opening event

Late 2015 the founding partners, the Capital Region of Denmark, the City of Copenhagen, the University of Copenhagen and the Technical University of Denmark invited to the grand opening of CACHET.

## CACHET seminars

CACHET has hosted 3 research seminars focusing on knowledge sharing and inspiring new research and innovation initiatives. Topics like diabetes, dementia, motivating physical activity, technology maturity and many other cross-disciplinary research challenges are being lively discussed.

## DTU High Tech Summit – Digital Health Track

CACHET hosted a Digital Health Track with support from MedTech Innovation and DTU Business during the two-day High Tech Summit at DTU. The seminar, workshop and stand had more than 250 visitors during the event.

## 3C Conference on Health Innovation

In cooperation with our sister organisations Copenhagen Health Innovation and Copenhagen Healthtech Cluster, CACHET organised a conference on the state-of-art and future perspectives of healthcare innovation with more than 450 attendees.



Photo: Jesper Rais



Photo: Jesper Rais

# About CACHET

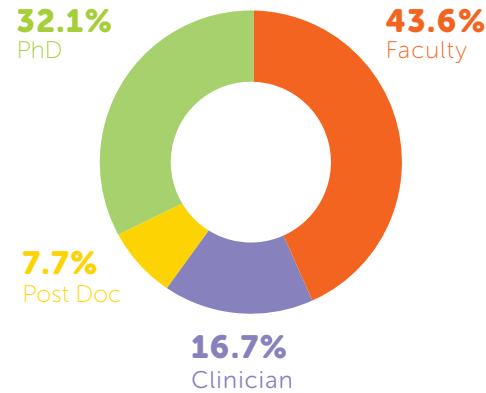
CACHET was founded in 2015 as a strategic partnership between the Capital Region of Denmark (CRDK), the City of Copenhagen (CCPH), the Medical and Health Faculty at the University of Copenhagen (UCPH) and the Technical University of Denmark (DTU).

The governance model of CACHET consists of a steering group as its highest authority, a director responsible for daily management and a management group for strategic development and management.

CACHET is a virtual research centre. This implies that there is a very lean centre staff consisting only of the centre director and a programme manager. Research is done in collaborative research projects that span across a wide range of departments at the four partners. By the end of 2017, more than 90 researchers were affiliated with CACHET.

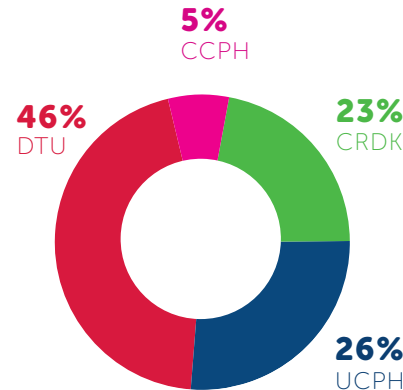
## Mission

CACHET will support and promote healthy living, active ageing and chronic disease prevention and management through the design, development, evaluation and implementation of personalised health technology



## CACHET researchers

Researchers divided into university faculty members from UCPH and DTU, clinicians from the hospitals in CRDK, Post Docs and PhD students.



## Researchers divided into primary affiliation

UCPH: University of Copenhagen  
DTU: Technical University of Denmark  
CRDK: Hospitals in the Capital Region of Denmark  
CCPH: City of Copenhagen

## Steering Group

**Ulla Wewer**, Dean, Faculty of Health and Medical Sciences, University of Copenhagen

**Rasmus Larsen**, Provost, Technical University of Denmark

**Katja Kayser**, Chief Executive, Health and Care Administration, City of Copenhagen

**Rosa Andersen**, Head of Unit, Department of Regional Development, Capital Region of Denmark

## Director

**Jakob E. Bardram**, Professor, Technical University of Denmark and Faculty of Health and Medical Sciences, University of Copenhagen

## Management Group

**Jan Madsen**, Professor, Deputy Head of Department, Department of Applied Mathematics and Computer Science, Technical University of Denmark

**Bente Stallknecht**, Professor, Head of Department, Department of Biomedical Sciences, University of Copenhagen

**Helge B. D. Sørensen**, Associate Professor, Department of Electrical Engineering, Technical University of Denmark

**Anders Lundbergh**, Senior Advisor, Department of Regional Development, Capital Region of Denmark

**Steffen Loft**, Professor, Head of Department, Department of Public Health, University of Copenhagen

**Monica Andersen**, Head of Department, Health and Care Administration, City of Copenhagen

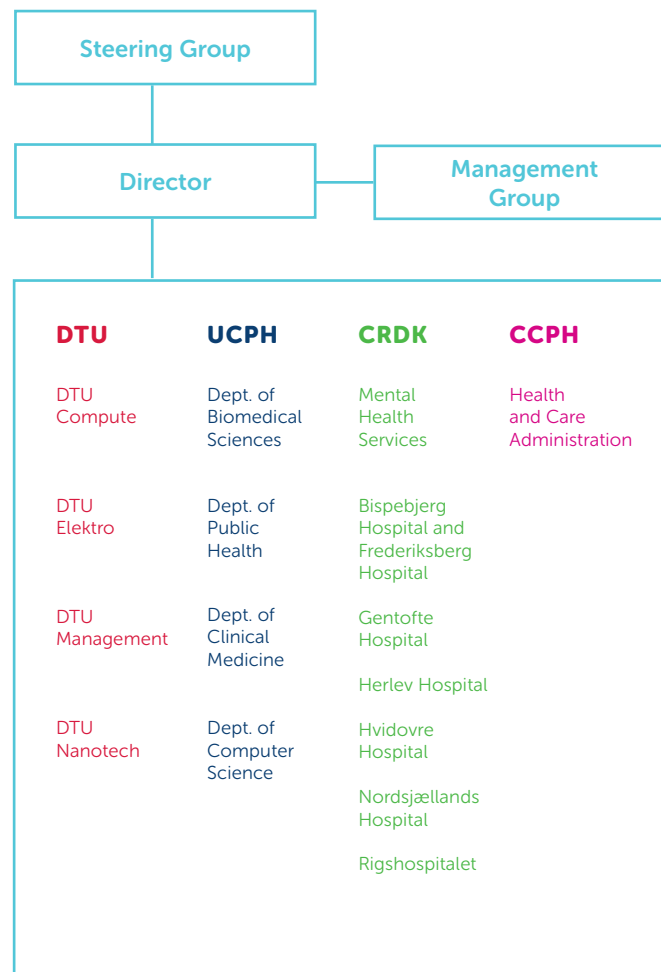
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**Jonas Bak**, Copenhagen Centre for Health Technology, Physical Medicine & Rehabilitation Research Copenhagen, Hvidovre Hospital

**Stephanie Mann**, Copenhagen Centre for Health Technology, Physical Medicine & Rehabilitation Research Copenhagen, Hvidovre Hospital



## PhD projects

**Personalising hearing care and enhancing user experience by adapting devices to the changing mobile context**, Benjamin Johansen, Department of Applied Mathematics and Computer Science, Technical University of Denmark. **Supervisor:** Jakob Eg Larsen.

**Behavioural design – from analysis to intervention to real world impact**, Camilla C.K. Nielsen, Department of Management Engineering, Technical University of Denmark. **Supervisor:** Philip Cash.

**WARD - wireless assessment of respiratory and circulatory distress**, Camilla Haahr, Department of Anesthesiology, Rigshospitalet. **Supervisor:** Eske Kvanner Aasvang.

**FitMum: Fitness for good health of mother and child**, Caroline Borup Andersen, Department of Biomedical Sciences, University of Copenhagen. **Supervisor:** Bente Merete Stallknecht.

**Systematic approach to vulnerable patients with mental illness in general practice. Needs, barriers, opportunities and expectations**, Christina Svanholm, Department of Public Health, University of Copenhagen. **Supervisor:** John Brodersen.

**eHealth with minors living with a chronic illness**, Claudia Bagge-Petersen, Department of Public Health, University of Copenhagen. **Supervisor:** Henriette Langstrup.

**Adaptive, context-aware cognitive behavioral therapy for affective disorders**, Darius Rohani, Department of Applied Mathematics and Computer Science, Technical University of Denmark. **Supervisor:** Jakob E. Bardram.

**Person-centric and device-agnostic activity-based integration in personal health technology**, Devender Kumar, Department of Applied Mathematics and Computer Science, Technical University of Denmark. **Supervisor:** Jakob E. Bardram.



## Gender balance



# 41%



**Portable diagnostic laboratory to diagnose thyroid gland related disorders**, Georgi Plamenov Tanev, Department of Applied Mathematics and Computer Science, Technical University of Denmark. **Supervisor:** Jan Madsen.

**The everyday life of people with severe mental illness and physical comorbidity**, Iben Emilie Christensen, Department of Public Health, University of Copenhagen. **Supervisor:** Susanne Reventlow.

**BCI Controlled functional electrical stimulation as a complete neurorehabilitation tool for post-stroke patients**, Jakob Møller, Department of Electrical Engineering, Technical University of Denmark. **Supervisor:** Sadasivan Puthusserypady.

**Machine learning for smartphone-based monitoring and treatment of unipolar and bipolar disorders**, Jonas Busk, Department of Applied Mathematics and Computer Science, Technical University of Denmark. **Supervisor:** Ole Winther.

**Engineering systems design in healthcare: smart wearables for dementia monitoring**, Julia Rosemary Thorpe, Department of Management Engineering, Technical University of Denmark. **Supervisor:** Anja Maier.

**Healthcare design for patient engagement and collaborative care**, Julie Falck Valentin-Hjorth, Department of Management Engineering, Technical University of Denmark. **Supervisor:** Anja Maier.

**Biological age; refinement and implementation**, Karina Louise Skov Husted, Department of Biomedical Sciences, University of Copenhagen. **Supervisor:** Jørn Wulff Helge.

**Monitoring of sleep disorders**, Mads Olsen, Department of Electrical Engineering, Technical University of Denmark. **Supervisor:** Helge B.D. Sørensen.

**COPD-WATCH - wireless prediction of respiratory complications in chronic obstructive pulmonary disease**, Mikkel Elvekjær, Department of Anaesthesiology and Intensive Care, Bispebjerg and Frederiksberg Hospital. **Supervisor:** Christian Sahlholt Meyhoff.

**Reducing the rate and duration of Re-ADMISSions among patients with unipolar disorder using smartphone-based monitoring and treatment**, Morten Lindbjerg Tønning, Psychiatric Center Copenhagen, Rigshospitalet. **Supervisor:** Lars V. Kessing.

**Adaptive, context-aware cognitive therapy for young mental health**, Pegah Hariz, Department of Applied Mathematics and Computer Science, Technical University of Denmark. **Supervisor:** Jakob E. Bardram.

**Design toolbox for personal health technology**, Raju Maharjan, Department of Applied Mathematics and Computer Science, Technical University of Denmark. **Supervisor:** Jakob E. Bardram.

**Motivational technologies for preservation of physical function in elderly**, Rasmus Tolstrup Larsen, Department of Public Health, University of Copenhagen. **Supervisor:** Henning Langberg.


**Smartphone-based electronic biomarker in patients with bipolar disorder, relatives and healthy individuals**, Sharleny Stanislaus, Psychiatric Center Copenhagen, Rigshospitalet. **Supervisor:** Lars V. Kessing.

**Smartphone-based electronic biomarkers in adolescents with unipolar disorder and bipolar disorder, their healthy siblings and healthy control individuals (BIO YOUNG)**, Sigurd Arne Melbye, Psychiatric Center Copenhagen, Rigshospitalet. **Supervisor:** Lars V. Kessing.

**Modeling of behavioral changes based on smartphone sensing**, Simon Due Kamronn, Department of Applied Mathematics and Computer Science, Technical University of Denmark. **Supervisor:** Jakob Eg Larsen.

**Predicting patient outcomes using vital signs monitoring**, Adnan Vilic, Department of Electrical Engineering, Technical University of Denmark. **Supervisor:** Helge B. D. Sørensen.

14 PhD students are funded by the CACHET PhD Programme. 26% of all CACHET affiliated PhD students are internationals.



59%

# Selected publications

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# Strategic Partnership

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