Norwegian Centre for
E-health Research

Annual Report 2019

Norwegian Centre for
E-health Research

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Content

Statement from Head of Steering Committee

2019 was another good year for the Norwegian Centre for E-Health Research. During the course of four years, the centre has become an important provider of knowledge renowned for its research.

Compared to previous years, the Norwegian Centre for E-Health Research has submitted more publications with a significant number at level 2. This is excellent and contributes to safeguarding the legitimacy of the Centre as a research institution within the field of e-health nationally and internationally.

Of the important contributions the Centre has made, I would especially like to mention the research on patient-centred healthcare teams emphasised in the National Health and Hospital Plan, the establishment of a national medication management network and the 'Connected Care Technology for Children and Adolescents with Functional Disabilities Project', which has provided important knowledge for a vulnerable group.

On 18 and 19 June 2019, I had the pleasure of taking part in a conference on 'Artificial Intelligence in Healthcare', organised by the Norwegian Centre for E-health Research and the Northern Norway Regional Health Authority in Bodø. More than 300 participants from home and abroad attended the conference with many influential names on the programme. The feedback shows that the conference was well received. I believe it was a success and helped promote the topic as well as profile the Centre. Bodø is a stunning city for such gatherings in the month of June! The Norwegian Centre for E-health Research would be delighted to hold similar events in collaboration with the other regions in the future, so please let us know if you are interested!

I took over as Head of the Centre's Steering Committee from Bjørn Engum at the turn of the year 2018/2019. I have ten years of

experience in research and development at Chr. Michelsens Institute in Bergen, albeit in the last millennium. In addition, I have more than 25 years of experience working within ICT development, initially at Haukeland University Hospital, and thereafter at hospitals belonging to the Western Norway Regional Health Authority. It has been both exciting and educational!

There is still a considerable amount to learn, especially with regard to the complexity arising from the digitalisation of work processes and organisations. I believe it was critical to implement the important initiatives that have been adopted in recent years to involve patients in the digitalisation.

The results from 2019 indicate that the Centre works diligently on it tasks and the forecasts for 2020 provide a solid foundation for further development of the Norwegian Centre for E-Health Research.

Erik M. Hansen,
Head of the Steering Committee

New Steering Committee from 2019

All the regional health authorities and relevant sectors are represented in the Steering Committee and the members serve for a period of two years at a time. The members can sit on the committee for two periods.

In 2019, the Steering Committee convened four times.

The purpose of the Steering Committee is to ensure that:

- the centre further develops its expertise and executes assignments within research and investigations on e-health in line with the needs and priorities of the health and care sector. If the Centre does not possess the relevant expertise, it may be developed at the Centre or acquired through collaboration with other relevant expert environments. This especially applies in fields where the health authorities request expertise and services from the Centre through annual assignment documents and letters of award.
- the Centre further develops its national and international role within research and investigation on e-health, and that the sector considers it a useful, relevant and competent actor.
- the professional activities, support and administrative tasks of the Centre are of a high quality.

Anne Granstrøm Ekeland, Professor, Department for Patient Pathways:

What was the best thing that happened to you in 2019?
In 2019, I contributed to the HTAi Annual Meeting in Cologne with five other colleagues where the main topic was Health Technology Assessment (HTA) and digitalisation. Together, we promoted process research on real data in connection with modernisation of electronic patient records and patient-centred teams. We argued for the use of critical-realistic reviews in systematic reviewing. We also emphasised research on the management of large-scale e-health programmes, and contributed to the discussion on the boundaries for positivist assumptions in e-health research. It was surprisingly enjoyable to participate in a plenum panel at the conference with, among others, the former Deputy Secretary General for E-Services and Innovation in Estonia, Ain Aaviksoo. This type of activity is important for building good networks for the Centre.

What are you looking forward to in 2020?
To continue strengthening the cooperation on HTA and that systematic production of knowledge on various aspects of digitalisation, especially the needs of users, shall increasingly form the basis for development within the field.

Steering Committee Members

- Erik M. Hansen, CEO, Western Norway Regional Health Authority ICT (Head of the Steering Committee)
- Finn Henry Hansen, Director, Northern Norway Regional Health Authority
- Siv Mørkved, Professor and Assistant Director of Health Sciences, Central Norway Regional Health Authority
- Ulf E. W. Sigurdsen, Head of E-Health,
- South-Eastern Norway Regional Health Authority (Deputy Nils Johannsen)
- Henrik D. Finsrud, Chief Adviser, the Norwegian Association of Local and Regional Authorities (KS)
- Wenche P. Dehli, Director of Interaction and Innovation, Kristiansand Municipality
- Anders Grimsmo, Professor, Norwegian University of Science and Technology (NTNU)
- Einar Bugge, Quality and Development Manager, University Hospital of Northern Norway
- Kirsten Petersen, Senior Adviser, Norwegian Directorate of Health
- Kjetil E. Telle, Director of Health Services Research, Norwegian Institute of Public Health
- Karl Vestli, Division Director, Norwegian Directorate of E-Health
- Egil Rye-Hytten, User Representative
- Bjørn Astad, Department Director, Ministry of Health and Care Services (Observer)

The organisation

Number of employees:

- 86 with 58.3 Full Time Equivalents
- 45 women and 41 men
- 56 full-time employees
- 30 part-time employees
- Seven affiliated positions
- 18 new employees in 2019

Age:

- Three between the age of 20-29
- 21 between the age 30-39
- 29 between the age 40-49
- 26 between the age 50-59
- Seven above the age of 59

Academic background:

- Nursing
- Social Science
- Technology
- Psychology
- Sociology
- Physics
- ICT
- Socioeconomics
- Education
- Medicine
- Organisation and Management
- Graphical Design
- Pharmacy
- Communication
- Physiotherapy
- Business Economics
- Journalism
- Biology
- Statistics
- Accounting and Audits
- Civil Engineering
- Biological Engineering
- Health Science

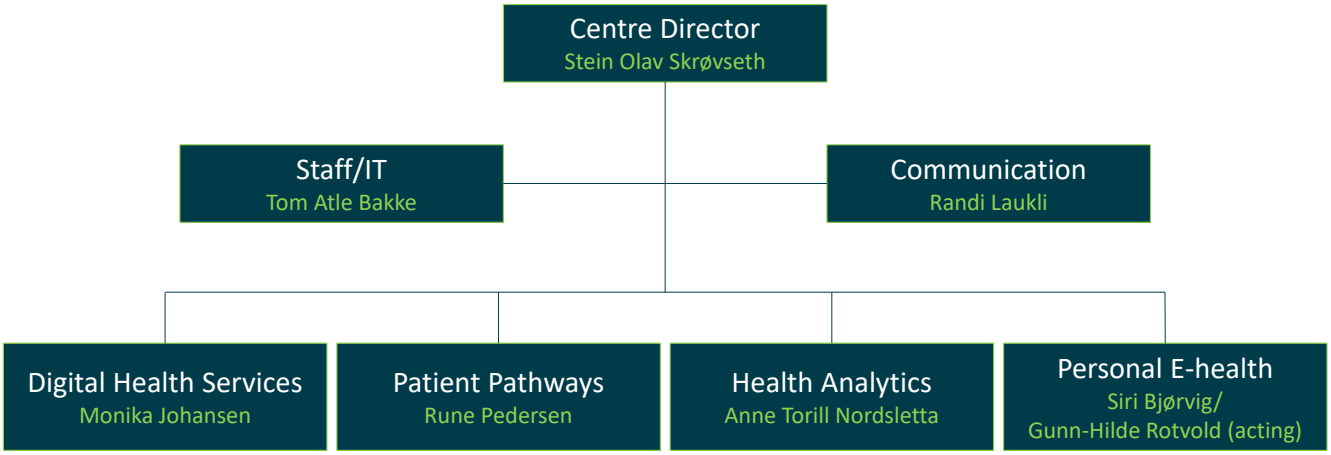
Level of education:

- Eight fellow researchers comprising of four women and four men
- 46 with a PhD comprising of 23 women and 23 men

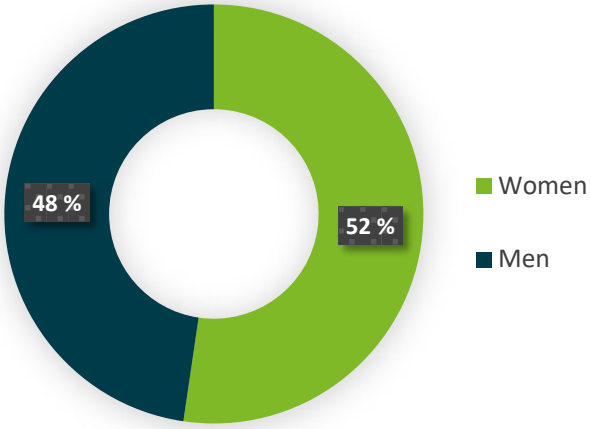
Where do we come from?

Most of us are from Norway, whilst 18 come from:

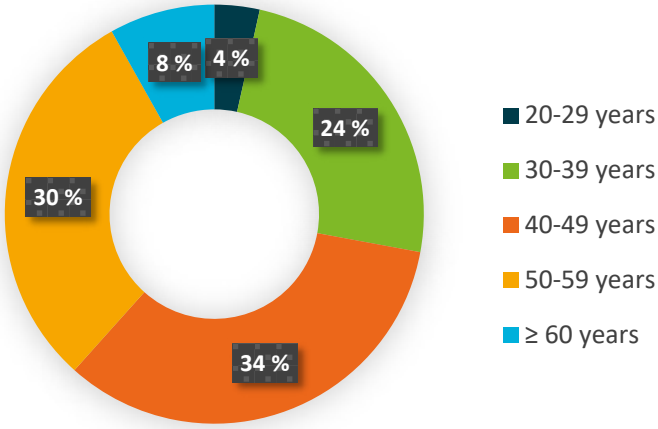
- Greece
- Spain
- Zimbabwe
- Italy
- Germany
- USA
- Lithuania
- Ethiopia
- France
- Russia
- Czech Republic
- Portugal
- Iran
- Vietnam



Gender distribution



Age distribution



Gunn Hilde Rotvold, Senior Adviser, Department for Personal E-Health:

What was the best thing that happened to you in 2019?
The best thing was substituting for Siri as head of the department for personal e-health. The department has an incredible number of fantastic, knowledgeable and friendly employees. It was a pleasure getting to know them and their projects even more. In addition, I had the pleasure of recruiting some new employees: Dillys (Larbi), Truls (Tunby Kristiansen) and Monika (Knudsen Gullslett) all of whom have enhanced both the department and Centre.

What are you looking forward to in 2020?
I am now looking forward to immersing myself in projects and, should the possibility arise, I would like to start a PhD course researching implementation processes. In the meantime, I have attended a systematic review course, and I carry out fieldwork and analyse ongoing projects, write reports and feel gratified acquiring new knowledge.

Centre Director's Report

The Norwegian Centre for E-Health Research grew in 2019 and we now have even more skilled and talented colleagues.

Needless to say, the need for knowledge in the field of e-health is considerable and increasing! It is developing more rapidly than before and connected care technologies, among others, is about to become an integrated part of healthcare. Major sweeping measures such as Akson, the Patient Medication List, and rolling out of more modern systems in hospitals are important research topics. At the same time, the technology is developing rapidly and society needs a research centre at the forefront with an overview and detailed knowledge of new and imminent technologies.

During the course of the year, the Centre has significantly established itself nationally. We have provided a substantial amount of relevant knowledge and cooperated well with authorities, academia and institutes. In addition, we have achieved immense exposure through events, such as the Copenhagen WHO conference in February, the Bodø Artificial Intelligence in Healthcare conference in June and E-health in Norway (EHiN)/Scandinavian Health Informatics conference in November. 2019 can be seen as the year the Centre grew and became more highly recognised. Anything produced from our centre is considered a stamp of quality, and we are heard and included in more and more contexts. This is important and an immense responsibility is incumbent on us for accuracy founded on excellent knowledge.

E-health is complex and it is not always easy to find good knowledge-based answers. One major strength that we possess is our interdisciplinary composition. We can see technology, society and clinical practice in context. We protect interdisciplinarity and culture to enable various professions and backgrounds to produce good answers together, whilst remembering that the objective can never be technology per se - the objective is always improved health and health services with the patient at the centre.

It is essential that the digitalisation of healthcare is conducted based on sound knowledge. Not only do we need to understand the technology, but also the impact it has on citizens and patients, health workers, organisations and overarching systems. The benefits may be huge, however, the unintentional consequences may be of equal importance. This is where our role as an independent research centre lies - we must pay attention and lead the way based on our experience, and speak up if we believe developments are heading in the wrong direction, ultimately based on knowledge and research.

Research is about developing knowledge and undoubtedly knowledge within the field of e-health is new. As such, it must be conveyed to those who need it in the right way at the right time. This is what we are doing and will continue to do.

Stein Olav Skrøvseth, Centre Director

We are social

After opening our Instagram account in 2018, we have published 137 posts and gained many followers. Numerous national and international educational and research institutions are on Instagram, so it is a good place for us to be - to follow what is happening, to make contact and to share the Centre's knowledge with the global
e-health community.

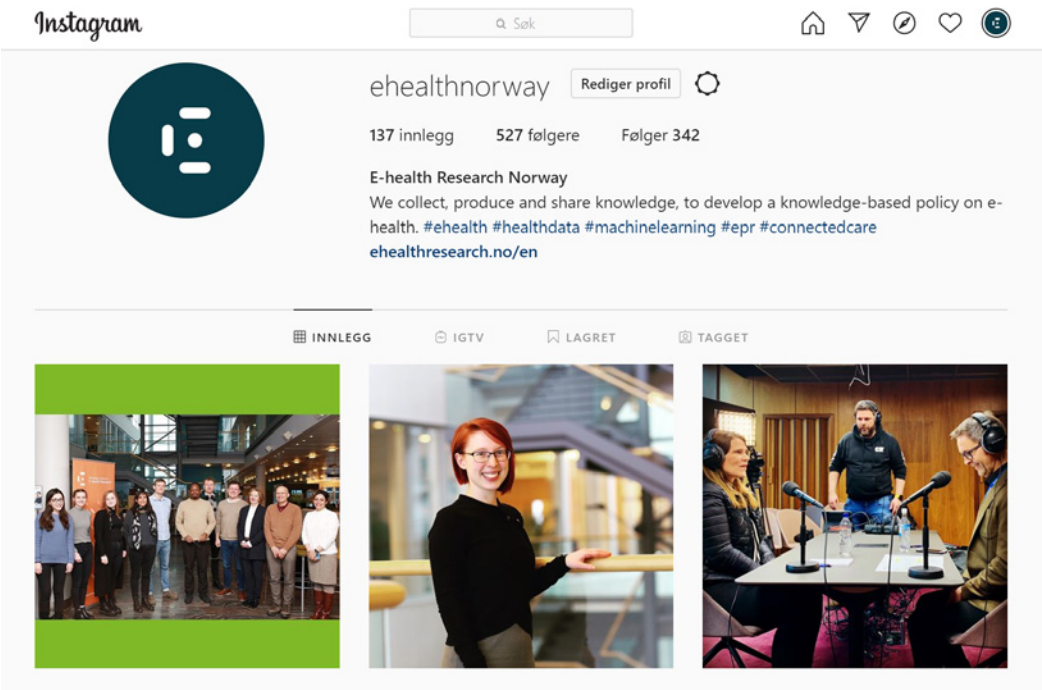
We aim to be open and accessible. Thus, we shall write in a comprehendible manner to reach everyone - even when addressing technical and complicated fields.

Facebook:
Our Facebook page has 2,251 followers.

Twitter:
1,219 people are following us on Twitter.

Instagram:
We have 527 followers on Instagram.

LinkedIn:
We have 928 people following us on LinkedIn.



Finances

Financial statement for 2019. Figures indicated in MNOK.

OPERATING REVENUE

Total revenue competitive funds	28,4
Total basic funding	43,0
Total revenue assignment funds	1,3
TOTAL operating revenue	**72,8**

OPERATING COSTS

Direct project costs	11,6
Payroll and social costs	49,2
Other operating costs	8,4
TOTAL operating costs	**69,2**
OPERATING RESULT	**3,6**
Operating result transferred to balance sheet	3,6
PROFIT/LOSS FOR THE YEAR	**0,0**

Monika Johansen, Department Manager, Digital Health Services:

What was the best thing that happened to you in 2019?
We have an incredibly exciting and motivating job! By researching the effects and consequences of the national digital health services that have been introduced, we have the opportunity to help improve the services. We published many exciting research results on accessing patient records and digital medication management, and we also established a research network within the field of medication with actors from around the country.

What are you looking forward to in 2020?
I'm looking forward to acquiring even more national and international collaborators, as well as presenting our research results in various spheres. At Medical Informatics Europe in Geneva (MIE), we will be meeting with the international network for researchers we have built up: Citizen and Health Data. I'm really looking forward to that!

Knowledge for Improved Health Services

The Norwegian Centre for E-health Research shall contribute to evidence-based development within the field of e-health through research, collaboration and dissemination.

Through interdisciplinary research and knowledge development, we want to help improve healthcare for citizens. Together with the whole sector, we shall achieve the national goal: the patient's health care service.

Our goal is to be a leading national and internationally recognised research centre.

Our vision is: Knowledge for better health services.

Our most important task is to conduct research with other professional environments nationally and internationally. Our research must be independent and maintain high ethical standards.

The dissemination of knowledge is a core activity and we will publish all our research in an open and accessible manner. We shall work for the knowledge to be used..

Through out national role, we will build networks and collaborate with the entire sector. Everyone who researches e-health will be able to join.

Personal E-health

We will conduct research on how technology for independency and self-management impacts the medical care of the elderly, the chronically ill who require monitoring, people with functional impairments and those who are actively changing their lifestyle.

Digital Health Services

We shall conduct research on the national digital health services and obtain knowledge on what conditions need to be in place before the services can be developed. Whilst the services are being tested, we shall look at what prevents or promotes usage of the services. To conclude, we will study the effects and consequences of using the services. The digitalisation of medications and the services offered on Helsenorge.no are important topics.

Patient Pathways

We study how digital solutions can facilitate holistic patient pathways.
Technological, semantic and organisational interaction is challenging in healthcare and we look upon patient medical records as a cooperation tool. We investigate how strategies for introduction, standardisation and work processes impact quality.

We research conditions for and the effects of digitalisation with the aim of understanding the complex interaction between technology and health services.

Health Analytics

We look at how health data can be used to predict, detect and treat illness.

Machine learning algorithms and data extraction methods are two areas that we study. We shall develop data analysis methods and protect privacy.

A key topic is how the health sector can adopt reliable and sustainable algorithms.

Vision and Values

Our vision is knowledge for better health services.

Values

Our values are crucial to our success over time and form the core of our culture. They motivate us to perform and guide us on how we should run the centre and cooperate with our stakeholders.

Openness

Openness is one of the most important values in our organisational culture, which helps to ensure transparent processes. By making our activities transparent and sharing knowledge and information, we build trust in our collaborators and society.

Openness validates a desire to learn, to be curious of others and receptive to new ideas. This also underlies the ability to give and receive constructive feedback. We value this highly.

Collaboration

E-health is an interdisciplinary field, and no one is capable of doing it all on their own. Collaboration is therefore something we hold in high regard. We often collaborate with those we compete with for funding. Trust lies at the heart of any good collaboration. Trust and respect for one another makes working together a joyful experience.

Inclusion is the key to building a community, and being part of a community provides a sense of belonging, friendship and wellbeing. By including everyone, both internal and external collaborators, we work more efficiently towards reaching our shared goals.

Integrity

To us at the Norwegian Centre for E-Health Research, integrity means being trustworthy and conducting ourselves properly. We are characterised by doing what we say. We are confident that we want the best for each other and that everyone is doing the best they can. Quality should be the hallmark of what we provide.

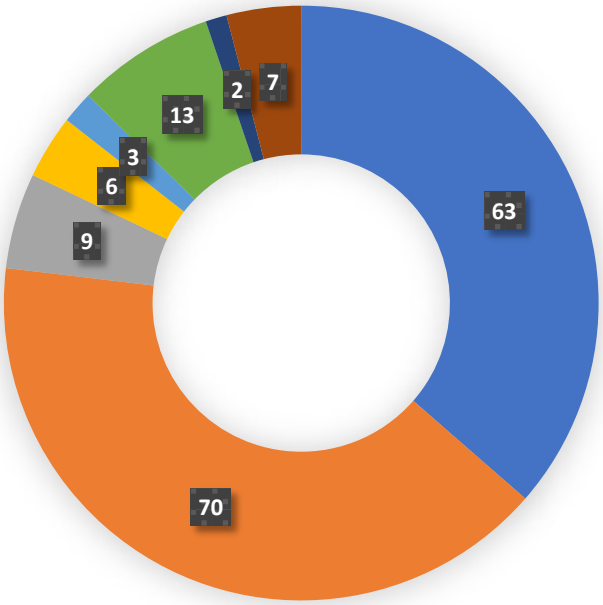
It is important to us to perform our public mission as best we can, which is why we must set clear expectations for the Centre and our employees. Our organisation wants autonomous, committed employees who take co-responsibility for the Centre's success. We must be able to depend on one another for support - even when we make mistakes.

Ove Lindtvedt, Senior Researcher:

What was the best thing that happened to you in 2019?
This would most definitely be my new job at the Norwegian Centre for E-health Research, as well as the opportunity to work with numerous applications that have given valuable insights into the professional fields at the Centre, and the establishment of contacts in several professional environments nationally and internationally.

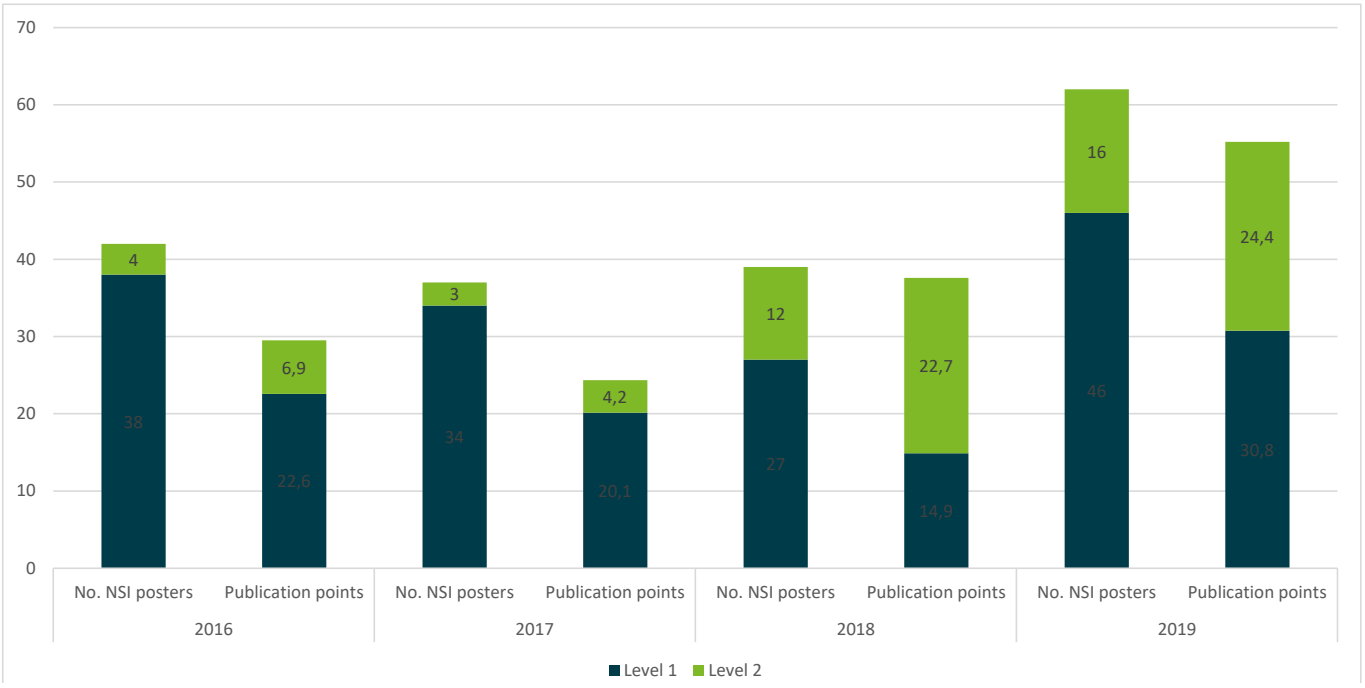
What are you looking forward to in 2020?
I'm looking forward to working with a national network for implementation research in e-health (NINe) and contributing with more applications.

Research Figures



- 63 scientific articles/overview articles
- 70 scientific/academic lectures and poster presentations
- Nine scientific chapters/articles/conference articles
- Six abstracts
- Three chronicles
- Thirteen popular science articles
- Two popular science lectures
- Seven reports

Numbers from Cristin



NSI: Norwegian Scientific Index
NSI publications: Publications that earn publication points and which are part of the funding schemes in the health, institute and university hospital sector

Research Collaboration

North America

Canada
- McGill University
- University of Toronto
- University of Victoria

USA
- University of Arizona
- Analytic Measures Inc
- Summit Health Informatics, Salt Lake City
- Johns Hopkins School of Medicine
- Louisiana State University
- University of Colorado at Boulder
- Columbia University in the City of New York
- University of Utah

South America

Chile
- Pontificia Universidad Católica de Chile

Europe

Belgium
- Hasselt University

Denmark
- Aalborg University
- Rigshospitalet - Copenhagen University Hospital

France
- Jean Minjoz Hospital
- Paris Descartes University

Italy
- IRCCS Saint John of God Clinical Research Centre
- University of Brescia
- University of Pavia
- University of Pisa

Lithuania
- Vilnius Gediminas Technical University (VGTU)

Norway
- UiT The Arctic University of Norway
- Nordland Hospital Trust
- SINTEF AS
- University of Oslo
- Norwegian University of Science and Technology
- Nord University
- OsloMet - Metropolitan University
- Norwegian Directorate of eHealth
- Haukeland University Hospital Trust
- Northern Norway Regional Health Authority ICT
- NORCE Norwegian Research Centre AS
- Oslo University Hospital Trust
- Norwegian Board of Health Supervision
- Sunnaas Hospital Trust
- Sørlandet Hospital Trust
- Municipality of Tromsø
- University of Agder

Slovenia
- University of Maribor

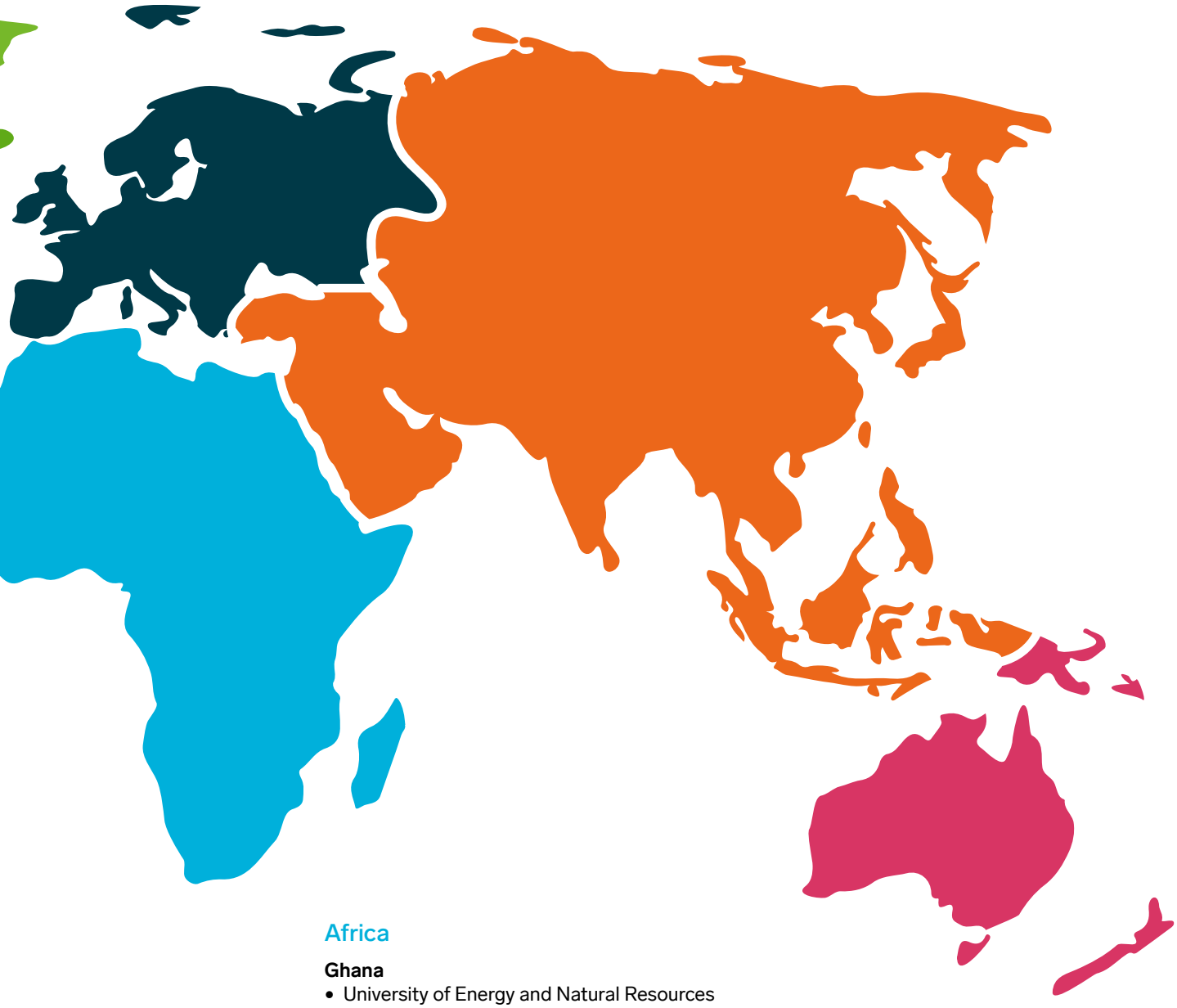
Spain
- Polytechnic University of Valencia
- IKERBASQUE - Basque Foundation for Science
- University Rey Juan Carlos (URJC)
- University of Seville
- University of the Basque Country
- Jaume I University

United Kingdom
- Brighton & Sussex Medical School
- EndZone
- University of Cambridge
- University of Huddersfield
- University of Nottingham

Switzerland
- Bern University of Applied Sciences
- Lausanne University Hospital

Sweden
- Blekinge Institute of Technology

Czech Republic
- Charles University in Prague



Africa

Ghana
- University of Energy and Natural Resources

Asia

India
- Sanwari Bai Surgical Centre

Iran
- Mashhad University of Medical Sciences
- Birjand University of Medical Sciences
- Hakim Sabzevari University
- Iran University of Medical Sciences and Health Services

Israel
- Ono Academic College

Oceania

Australia
- Monash University
- University of Melbourne
- La Trobe University
- Macquarie University
- Royal Prince Alfred Hospital
- Swinburne University of Technology
- University of Wollongong

New Zealand
- University of Otago

Papua Ny-Guinea
- Daru General Hospital

WHO Conference in UN City – Copenhagen

This international conference on digital health was organised for the first time by the WHO/Europe in cooperation with the Norwegian Centre for E-Health Research from 6-8 February.

The objective was to get the member countries in the region to prioritise important healthcare initiatives, and develop and use digital healthcare tools and IT systems. The aim was an exchange of useful and updated knowledge of all the sub-areas of e-health. Many ministers, dignitaries, experts and researchers from 50 countries participated.

Technology and how it can empower citizens and health workers was discussed. Data-driven decision support for clinical information systems was one topic, in addition to e-prescriptions and mobile healthcare. Furthermore, the question of how artificial intelligence and machine learning can be used to improve diagnostics and treatment, and how it can be ensured that ethical issues are satisfactorily taken care of when health services are digitalised were deep conversation topics.

- Dr Hans Kluge, Director of the Division of Health Systems and Public Health at the WHO's regional office in Europe, established that to succeed with digitalisation in national health services, European countries needed a vision and roadmap.

The organisers and participants expressed that they were very satisfied with the Symposium, which the WHO would like to repeat annually in the future.

Key figures:

- 50 countries
- 366 participants
- 93 speakers
- 5 plenum sessions
- 24 parallel sessions
- 4 seminars


UN CITY


FUTURE OF DIGITAL HEALTH SYSTEMS
WHO SYMPOSIUM
6-8 FEBRUARY 2019
Norwegian Centre for E-health Research
World Health Organization
Europe


FUTURE OF
DIGITAL
HEALTH
SYSTEMS
World Health Organization
Europe


#digitalhealth
#HealthForAll
World Health Organization
Europe
Norwegian Centre for E-health Research
FUTURE OF


Today
FUTURE OF
DIGITAL
HEALTH
SYSTEMS

Artificial Intelligence – International Conference

The conference in Bodø on artificial intelligence and machine learning in healthcare was a success. International experts from IBM Watson and the world-renowned Mayo Clinic et al. attracted 300 interested participants.

Norway must reap the rewards from the experience gained from big data and artificial intelligence in the health sector from the world leaders in this field.

It was decided that the Northern Norway Regional Health Authority and the Norwegian Centre for E-Health Research would organise a two-day international conference on the topic in June. Department Manager, Anne Torill Nordsletta and her colleagues at Health Data Analytics were assigned the task of planning the conference.

The programme offered a number of exciting topics, for example:

- The Impact of Genomics in Medicine and Clinical Research
- Bioinformatics in clinical applications
- Electronic Health Records and Artificial Intelligence for Disease Forecasting and Biomarker Discovery
- Multimodal imaging, deep learning and visualization in clinical imaging research
- Implementation of artificial intelligence in orthopaedic radiology
- Clinical text mining – Secondary use of electronic patient records to improve healthcare

- "We used our entire international network to invite speakers. I'm very happy that so many talented researchers accepted the invitation to participate. As such, we could offer a very wide range of fields on the agenda, thus demonstrating what can be included in the health services of the future," says Anne Torill Nordsletta.

Dagens Medisin is Norway's largest newspaper for the health service. They covered the conference and interviewed George Vasmatzis et al. from the Mayo Clinic, who was cited as follows:

"I understand that this is challenging. Doctors are trained in one way - and they want simple methods and standards to follow when treating patients. One oncologist from the Mayo Clinic sees 15 patients per day, which is a considerable amount of information for one doctor to handle. In my opinion, we must therefore move away from such an individualistic mindset: One doctor should not treat many patients with the same illness - several practitioners should be observing one patient.

You can find all the presentations from the conference here:

https://ehealthresearch.no/presentasjoner

Screenshot from Dagens Medisin about the conference

DAGENS Medisin

Nyheter Debatt Pharma DM Arena

- Vi må bort fra en individuell tankegang i helsetjenesten: Det skal ikke være èn lege som behandler mange pasienter som har samme sykdom – det skal være flere behandlere som ser én pasient, sier George Vasmatzis fra Center of Individualized Medicine ved Mayo-klinikken i USA. Han innledet på Helse Nords konferanse om kunstig intelligens i helsetjenesten tirsdag. **Foto:** Anne Grete Storvik

KUNSTIG INTELLIGENS I HELSETJENESTEN

– Flere fag må samarbeide om behandlingen

Maryam Tayefi, Senior Researcher:

What was the best thing that happened to you in 2019?
Just after I started working for the Norwegian Centre of E-Health Research, we organised the spectacular artificial intelligence conference in Bodø. The Centre had prepared the conference long before I was employed, but I was still given the opportunity to take part. I have extensive experience with holding conferences, but this was a new experience with new colleagues and cultural differences. I acquired a lot of knowledge about artificial intelligence.

I wrote my first application for Northern Norway Regional Health Authority in 2019. In connection with this, I visited a renowned professor at the University Hospital of Northern Norway. His field of expertise was vitamin D and I learnt a considerable amount from his experience.

Electronic phenotyping is my research area and I have just started with Natural Language Processing (NLP). In 2020, we will be holding a workshop on NLP: Clinical text mining in patient record systems.

What are you looking forward to in 2020?
I'm looking forward to acquiring more collaborators nationally and internationally to give us more knowledge and experience. My focal point will lean more towards European applications and projects.

As a recipient of health services, what is important to you?

The most fundamental aspect of good cooperation is understanding what is important to the recipient of healthcare.

"Patients with multiple needs are passed around in healthcare. At the launching conference for the National Health and Hospitals Plan for 2020-2023, the Norwegian Health Minister, Bent Høie, said that the most vulnerable patients, who need coherent services the most, must be exempted from having to coordinate the services themselves."

The most vulnerable patients require better cooperation

The patients, who will be given priority in the new health and hospitals plan, are vulnerable children and adolescents, the mentally ill and those with drug and alcohol problems, people with complex needs and frail elderly persons.

This requires improved cooperation internally in hospitals, and between the hospitals and municipalities.

Along with the Norwegian Association of Local and Regional Authorities (KS), the Government is planning to establish 19 healthcare communities across the country. The healthcare communities shall incite hospitals and the municipalities to improve the methods they employ when discussing patients. The health communities give the municipalities and the hospitals a more active and binding role.

A lack of cooperation results in treatment burden

Gro Berntsen, a doctor and professor at the Norwegian Centre for E-Health Research, has spent many years studying how people with complex needs receive health services. She welcomes the Government's new initiative.

"The four groups that the Government has pointed out can be designated under one common term: patients with long-term and complex needs. They must live with their ailments over time. If the health service remains uncoordinated, they will have a treatment burden in addition to the challenges they already have," emphasises Berntsen.

The common factor for this patient group is that they are vulnerable to rapid and serious deterioration if they do not receive help once the alarm bells ring.

Reference:

The 3P project – Patients and Professionals in Partnership.
https://ehealthresearch.no/3p

Gro Rosvold Berntsen, Markus Rumpsfeld and Monika Dalbakk are responsible for the research showing that patients who receive coordinated health services have a 43 percent better survival rate than those receiving treatment from the ordinary healthcare system.

The patient's goals must be the steering factor

"If we do not adopt the concept of preventive thinking, we will create more work for ourselves and more unhealthy patients. Self-treatment and planned risk-coping strategies must be the backbone in patient healthcare," says Berntsen.

"Health services have become very specialised. Putting together a health service that offers the correct competence in the right place at the right time will become more and more important. If we are to succeed, everyone who will be working together must have common goals. The patient's goals must steer the collaboration," she concludes.

Margunn Aanestad, Professor and Technical Manager at the Centre for E-Health, University of Agder

The public health service is about to face major restructuring in relation to preventive, patient-centred and integrated services. Adequate usage of digital technology is important to achieve the goals, and e-health research can provide knowledge on digitalisation processes, and contribute with reflection through follow-up research and documentation of the effects of measures. The researchers can also bring into play new ideas and solutions through use and user-centric innovation, and they can challenge and ask critical questions pertaining to assumptions, choices and consequences. In order to deliver good research on the major restructuring that will take place, we need different types of research and researchers from various professional fields.

Machine learning and artificial intelligence - what is the status?

We continually hear that artificial intelligence and machine learning will change healthcare in radical ways, and that we are about to face a paradigm shift.

Developments in radiology, genetics, natural language processing, sensor technology and many other fields enable us to collect large volumes of patient data. By using insight and new tools, patients can receive more accurate diagnoses and tailored treatment.

Alexandra Makhlysheva and Maryam Tayefi from the Norwegian Centre for E-Health Research held a 'Lessons from Norway' presentation on the topic at the EHTEL Symposium in Barcelona in December 2019.

Must solve the challenges

Healthcare is about to encounter major challenges. Both the number and percentage of elderly persons are increasing. The prevalence of chronic illnesses is increasing in line with the aging population. Therefore, the need for health services will significantly increase in the future. Currently, we do not have enough medical specialists and the situation will become even more critical. All these factors impact the cost of healthcare and social services and put pressure on the public health service.

"The challenges are lining up, but technical development is one key to the situation. We need to find out how the analysis of health data can contribute towards creating good health services in the future," says Makhlysheva.

In order to maintain today's standard of healthcare, we will need new solutions than can deal with demographic challenges

Senior Adviser
Alexandra Makhlysheva

Kari J Kværner, Professor D.M.Sc, Centre Director of C3 - Centre for Connected Care

The dream in a complicated healthcare service is to have problem-free exchanges and active patients. In the not too distant future, technology, digitalisation and new services will go hand in hand.

Today's technology allows us to treat children, adolescents, the elderly and the very ill at home. It is now increasingly possible to move diagnostics and treatment out of hospitals, and the chronically ill are followed up in their own homes. Hospital at home is not a vision for the future, the creation of healthcare communities should equip us to make an effort together.

It concerns the implementation and scaling of good health services, a task for which expert medical environments have an overall responsibility to become involved in for innovative thinking.

In my opinion, the most important thing we can do at the present time to support the willingness to modernise and make changes, is to contribute with tools for correct decision-making and for speaking the same language. If our methods enable us to support decision-makers, unite the various needs and prerequisites across the different levels in healthcare, increase the willingness to take risks in the health service and provide a framework for implementing new knowledge, technology and changes, then we have certainly contributed with something valuable that will really be of great importance to many people.

and reflect the new clinical picture without affecting the quality or safety of the services.

"Everyone who works with health data must pay close attention to maintaining privacy and information security. When developing new solutions, the actors must give these factors top priority in their plans," says Makhlysheva.

Advantages of machine learning

Machine learning, natural language processing and deep learning with neural networks can be used to analyse health data. Machine learning can contribute in so many positive ways, for example, reduced administrative costs, decision support for clinicians, better coordination of tasks and services, and not least improved patient health. Machine learning is also beneficial in monitoring the health of the population, robotic surgery, personally adapted medications, the development of medicines and optimal treatment methods.

"Nevertheless, we must also be aware of the problems of using machine learning. We need to manage the data and ensure data is not lost. We need to create algorithms that clinicians can understand. Healthcare data silos need to be opened and electronic patient records must be standardised," she says.

The Norwegian vision for the future health service "One Citizen - one Health Record" emphasises increased and simplified use of health data for quality improvement, health monitoring, management and research. There are however several obstacles: health data is distributed between various institutions and it is difficult to share data due to insufficient legislation and IT infrastructure.

"Our department builds knowledge on the new technology brick by brick. There are many research environments in Norway committed to developing expertise within the various sub-areas of artificial intelligence. One of the areas that we have chosen as a speciality is electronic phenotyping. It is essential to find out how we can benefit from structured and unstructured data in electronic patient records. Clinicians, researchers, patients and authorities greatly need us to succeed in reducing data and to use it in the best possible way for everyone," concludes Alexander Makhlysheva.

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https://ehealthresearch.no/faktaark/utforsking-av-elektronisk-fenotyping-for-klinisk-praksis

Online contact with GP surgeries reduces patient waiting times

When more people book appointments and renew their prescriptions online, fewer patients have to wait in call queues and at GP surgeries.

When GPs use digital services via the Helsenorge.no portal, fewer patients end up in call queues or sitting in the waiting room. For the patient, this could mean not having to travel to the surgery and having to lose salary. GP surgeries have fewer administrative tasks and shorter call queues.

Together with colleagues, researcher Asbjørn Fagerlund at the Norwegian Centre for E-health Research, has examined how nine GPs use four digital services offered on the Helsenorge.no portal.

Examined four digital GP services

The researchers interviewed the GPs about four digital services:

- Book an appointment
- Renew a prescription
- Start an e-consultation
- Contact the GP surgery

"When it came to the booking service, the GPs were happy. They found that it was time-saving and gave them increased flexibility," says Fagerlund.

He adds that the GPs also said that some patients missed talking to a medical secretary at the GP surgery, as they were accustomed to.

In terms of the digital service 'Renew a Prescription', the researchers observed that GPs organised their routines differently. GPs are self-employed and run their practice as they see fit. Some of them made the health secretary randomly sort out the electronic requests, while others received all the messages in their inbox. Some doctors pointed out that the messages could lead to more work.

Requires good routines and information

'Start e-consultation' was the only clinical service of the four. This is electronic communication between a patient and GP whereby the patient logs into Helsenorge.no and sends a written medical question.

"Some doctors said patients expressed themselves more openly in writing and addressed things they wouldn't otherwise do. It could be about mental health or shameful issues. Many people who have tried this service are looking at the use of video consultation as a next step," says Fagerlund.

He says that the doctors realised that they had to establish routines for the new digital services. For example, if a doctor is absent, arrangements have to be made for the requests to be sent to a locum who can respond.

Researcher Asbjørn Johansen Fagerlund

Not always suitable

"We discovered that the new digital services will not be suitable for people with poor digital skills - those who are not comfortable with using a computer or the Internet.

As this gradually becomes available to more people, it will be important to measure the actual consequences of digital services for citizens in terms of running a GP surgery and the patients' perception of the whole system.

Reference:

Fagerlund A.J., Holm I.M. og Zanaboni P.: General practitioners' perceptions towards the use of digital health services for citizens in primary care: a qualitative interview study. BMJ Open. Mai 2019

Giske Ursin, Director, Cancer Registry of Norway

Holograms, robotic surgery and AI are exciting, but something as elementary as structured electronic patient records in healthcare is still lacking, and for us at the Cancer Registry of Norway, it will always be essential to have this in place.

This requires a change in attitudes, which demands a lot from both health personnel and managers. For hospitals, however, such structure is important for adequately following up their own patients. Structure and uniform systems are necessary to transmit electronic health data to central health registers rapidly and effectively. Structure also provides citizens and authorities with more possibilities for monitoring what the health service is doing.

Interconnection and the standardised processing that takes place in central health registers are critical for ensuring that the quality of health data remains high. Furthermore, there must be close links and close cooperation between those who assure the quality of the data and those who do research on it.

Low quality data is widely available worldwide. Norwegian health data is unique in that it is complete and of high quality. This quality must not be compromised.

Testing of the Patient Medication List

The Patient Medication List is a new electronic list, which Norwegian health personnel will test from 2020. What do the authorities aim to achieve with the new system? What does the research say about the benefits of such medication lists?

Many people have great expectations of health workers being able to use the Patient Medication List. The testing of the new system, which will gradually be implemented nationwide, will start next year.

The Patient Medication List shall make information about a patient's medication available to health personnel by means of one shared national list. The list is being introduced due to an inadequate flow of information on the medicinal treatment of patients across healthcare sectors, for example, GP surgeries, hospitals and pharmacies.

Gathered the experiences of eight countries

Since medication errors are a problem, many countries want to have a national medication list.

"We have reviewed nine studies from eight countries. All studies stem from primary healthcare. We have summarised the studies in relation to how health personnel and patients use a shared medication list," says Researcher Unn Sollid Manskow.

Together with two colleagues, Karianne Lind and Trine Bergmo, she looked at studies from Norway, Sweden, the UK, Germany, Switzerland, Austria, the USA and Canada.

Easy to use, good training

In terms of patient safety and quality of the services, Manskow and her colleagues found a lot of useful information and ideas during their review.

"In a UK study, they found that a shared medication list led to less risks for patients. Health personnel made fewer mistakes on medication lists and believed that errors and harm could be prevented," she says.

An Austrian study pointed out matters that were important to doctors and pharmacists: A shared medication list had to be national and everyone had to use it. The interface had to be simple and they had to receive adequate training on how to use the system.

A Swedish study showed that doctors thought it was positive when they received a regional medication list. Yet, there were some disad-

Researcher Unn Sollid Manskow

What is important to you?

Karl Stener Vestli, Norwegian Directorate for e-Health

The Norwegian Directorate of e-Health has many exciting and challenging tasks lined up for the next few years.

We need to develop services that help citizens take a more active role in their own healthcare, and we need to make sure that we have a profitable healthcare industry working in partnership with the public health service. Health personnel must be given adequate tools, especially good patient record systems with transverse interactional features, to provide us with good and safe patient pathways. The work connected with the healthcare platform in Central Norway, Akson – records in other municipalities – and further development of interactional solutions between the primary and specialist health services, will therefore remain important projects in forthcoming years.

Safe operation and further development of national e-health solutions will be attained through new funding models. We're looking forward to developing a health analytics platform that will contribute towards realising more of the potential embedded in the data in reliable Norwegian health registers, whilst ensuring that we take care of citizens' trust through the right privacy policy.

vantages as well. They found prescriptions that no longer applied to patients and they were unable to share the list with other regions.

Nothing about people's health

"None of the research that we read established whether the patients had fewer ailments or improved health due to the practitioners installing new IT systems. More research is certainly needed on this," emphasises Manskow.

To conclude, the researchers only found a few studies with differing experiences. The countries have created different solutions, but to date none of them have been introduced nationally.

Unn Sollid Manskow is particularly interested in one matter:

"Very few researchers had asked nurses about their experiences with medication lists. Yet often it is nurses who order, administer and observe the effects of medicines. There is a high risk of taking the wrong medicine in all parts of the chain and we also need to know about the experiences of nurses," she says.

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Unn S. Manskow mfl.: Digital solutions for a shared medication list. A narrative literature review. Linköping University Electronic Press, 2019. (Sammendrag)

New Healthcare Technology May Result in more Work for Families

Digital health services may affect and change family life. The researchers believe that the social consequences of this technology need to be highlighted.

The health service is following up more and more patients with digital tools that they can carry on their person or have at home. Will this have a fundamental impact on the individual and will it change society?

In cooperation with colleagues from the University of Southampton, the Norwegian Centre for E-Health Research has analysed 15 European studies on e-health and developments in the past 20 years.

The findings show that digital health services or e-health among others change the way in which families deal with healthcare.

May affect gender roles and family structure

The findings show that e-health solutions do not only change the relationship between patients and health personnel, but potentially family and gender structures as well.

"We know that digitalisation affects individual persons, but all the studies show that the changes also affect society, the health service and family life," says Hege K. Andreassen, Senior Researcher at the Norwegian University of Science and Technology (NTNU) and the Norwegian Centre for E-health Research.

She says that they can see that the introduction of e-health may have major consequences. Because what happens at home when someone in the family is ill and increasingly managing at home with the help of technology, rather than travelling to a health institution? Will everything be positive?

Changes in the health profession

As digitalisation of healthcare increases, new industries are created. Companies who take care of patients by telephone, e-mail or chat services are being established.
The companies employ nurses, but also personnel without any formal medical training.

"Digitalisation accommodates other professions and new ways of organising work, also within development and IT operations. Health informatics has therefore become increasingly important in the health service," says Kari Dyb, one of the other researchers behind the article.

Affects family life

Health technology at home will affect the family. When one member of a family becomes ill, the other members of the family take on new tasks, for example, health monitoring and digital communication with the doctor.

Andreassen believes that choosing healthcare technology may also be a step backwards to traditional gender patterns should mothers and daughters end up staying at home taking care of the family's health through these new tasks.

Senior Researcher Hege K. Andreassen

Senior Researcher Kari Dyb

Both liberating and invasive

In one of the studies from 2012, a portable heart rhythm monitor was tested on patients who told of their experiences with the technology. Some chose not to use the device because they were embarrassed by the high-pitch noise that sounded each time it took a reading.

In other studies, people said that the monitoring technology was liberating, as they no longer needed to sit and wait at the hospital for an examination. Another study looked at how the homes of chronically ill patients were invaded by technical equipment, and the way their family living rooms were practically turned into infirmaries.

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Hege Kristin Andreassen, Kari Dyb, Carl May, Catherine J. Pope og Line Lundvoll Warth: Digitized patient–provider interaction: How does it matter? A qualitative meta-synthesis. Social Science and Medicine. 2018.

Difficult to Research the Effect of Healthcare Apps

E-health researchers believe that traditional research does not provide enough satisfactory answers in relation to how mobile healthcare tools affect patients.

Researchers at the Norwegian Centre for E-Health Research and OsloMet - Oslo Metropolitan University have studied a group of patients who have the Diabetes Diary self-help app on their mobile phone.

By analysing how the study subjects use the app, the researchers wanted to find out more about the effect such apps have on patients' health. According to this study, patients with diabetes type 2, who record their blood sugar, diet and physical activity can reduce their long-term blood sugar levels.

PhD student, Meghan Bradway, was involved in the analysis of the logs of 101 diabetes patients, all of whom used an earlier version of the Diabetes Diary mobile app.

The researchers concluded that the traditional way of conducting randomised controlled studies is not suitable for researching mobile health technology.

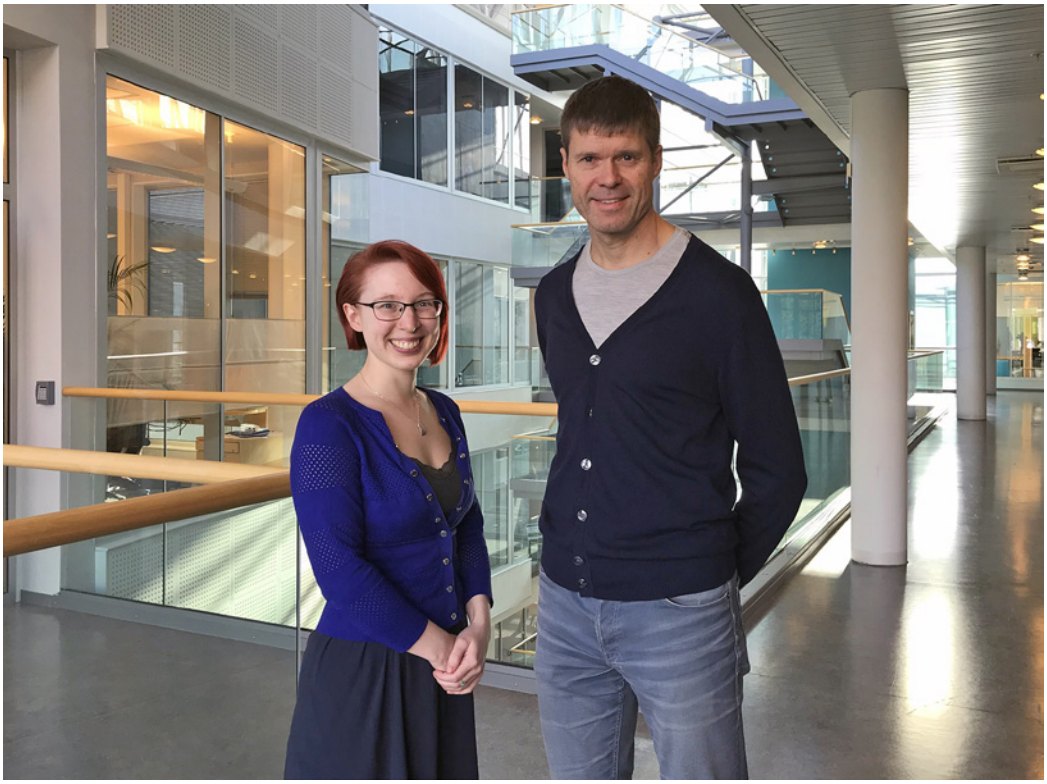
Each click must be analysed

"It depends on which telephone or smartwatch the patients have and whether they have any experience with technology or even like to use apps," says Meghan Bradway, who believes it is necessary to analyse every click on the screen to understand what is happening.

The study subjects were divided into groups according to how much or little they used the app.

The study showed that 29 did not use the app at all, 11 used it occasionally and 61 patients a lot. The result was positive: Over a prolonged period of time, the 61 active users reduced their long-term blood sugar by 0.86 percent.

Researcher Meghan Bradway and Professor Eirik Årsand



This is considerable since it is recommended to keep blood sugar levels lower than seven percent.

Active study subjects reduced their blood sugar levels the most

"We noticed that the study subjects who recorded food and physical activity were the ones who were truly interested in self-care. The long-term blood sugar levels of these study subjects went down even more. We wouldn't have found this out if we hadn't gone into the logs and analysed user patterns," says the researcher.

Smartwatches can log sleep and physical activity. Some diabetes patients have medication devices that can send information to the app or other devices they want to receive the information. As such, they do not need to remember to record how much medication they have taken.

Smartphone course

There could be many reasons why some patients manage to reduce their long-term blood sugar levels. Some see the benefits of mobile healthcare technology, whilst others need support and motivation to get started.

The researchers believe that a smartphone training course could be a good idea for those who are considering using apps, for example, disease self-management apps. In the meantime, those who already use such apps could receive even more information about their own health.

Meghan Bradway, Eirik Årsand et al. are currently carrying out a new study to test how patients with diabetes can share data with health personnel in new ways. In the project, patients can send data online during a physical consultation or remote consultation.

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