

 **UiT Norges arktiske universitet**

# **Fortellingen om en digital helserevolusjon og nord-norsk e-helseforskning**

**Gunnar Hartvigsen, professor**

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Institutt for informatikk, Universitetet i Tromsø – Norges arktiske universitet*

*Institutt for helse- og sykepleievitenskap, Universitetet i Agder*

*Senter for e-helse, Universitetet i Agder*

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## **Innhold**

- **Nytt studium i og for region Helgeland**
- **Et eksempel fra våre MSc-studenter**
- **Utviklingen nasjonalt innen e-helse**
- **NHS (UK) sine planer**
- **Det neste store målet innen helse(?)**
- **Nordnorsk pionervirksomhet**
- **Flere eksempler fra vår egen forskning**
- **Kunstig intelligens (AI)**
- **Helsesektoren følger etter utviklingen i samfunnet**

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## **Erfaringsbasert master i digitale helsetjenester (UiT)**

- Studiet retter seg bredt mot ansatte innen helsesektoren som ønsker seg tilleggs-kompetanse innen digitale helsetjenester.
- Masterprogrammet er erfaringsbasert – krav om min 2 års relevant praksis fra helsesektoren.
- 50% studieprogresjon og er tilrettelagt for studenter som arbeider ved siden av studiet.
- Videreutdanningstilbudet vil øke kompetansen til helsepersonell og ansatte i helsesektoren innen digital helse, inkludert kliniske IT-systemer, velferdsteknologi, e-helse, digital hjemme-oppfølging, mv.
- Oppstart høsten 2022.

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# **EKSEMPEL PÅ STUDENT- PROSJEKT**

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## **ET FORSKNINGS-EKSEMPEL**

**Økt fysisk aktivitet for personer  
med psykisk utviklingshemming**

7

Effects of physical activity with  
e-health support in individuals with intellectual disabilities

8

**UTVIKLINGEN  
NASJONALT  
INNEN E-HELSE**

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- Helse- og omsorgssektoren har tatt i bruk både ny og eksisterende teknologi i et høyere tempo enn tidligere.
- E-konsultasjon ble periodevis i 2020 mer brukt enn vanlige konsultasjoner, selv om kun en liten andel leger hadde tatt dette i bruk før koronapandemien.
- Et annet område med vekst siste år er digital hjemmeoppfølging. Dette har blitt brukt av nye pasientgrupper og gitt stor nytteverdi, spesielt for oppfølging av koronasyke og pasienter i risikogrupper.
- I tillegg til e-konsultasjon og digital hjemmeoppfølging, ser vi at interessen for dataene som samles inn fra smartklokker, apper, sensorer og lignende øker.

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Fig. 3.5

### Spørsmål om persongenererte data i Helsepersonellundersøkelsen 2020

#### Helsepersonell i 2020:

Hvor viktig tror du persongenererte data vil være i fremtidens helsevesen?



Kilde: Helsepersonellundersøkelsen 2020, Direktoratet for e-helse

En undersøkelse gjort av Direktoratet for e-helse viser at **38 % av befolkningen** har tatt i bruk **smartklokke/-pulsklokke** og **27 %** har tatt i bruk **helse- og livsstilapper**.

79 % av respondentene under 30 år har tatt i bruk en eller flere typer, mot 39 % i aldersgruppen over 60 år.

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## Innlogginger og besøk

Helsenorge.no hadde omtrent  
**72,9 millioner**  
besøk i 2020.

I snitt var det om lag  
**6 millioner**  
besøk i måneden i 2020.



Om lag

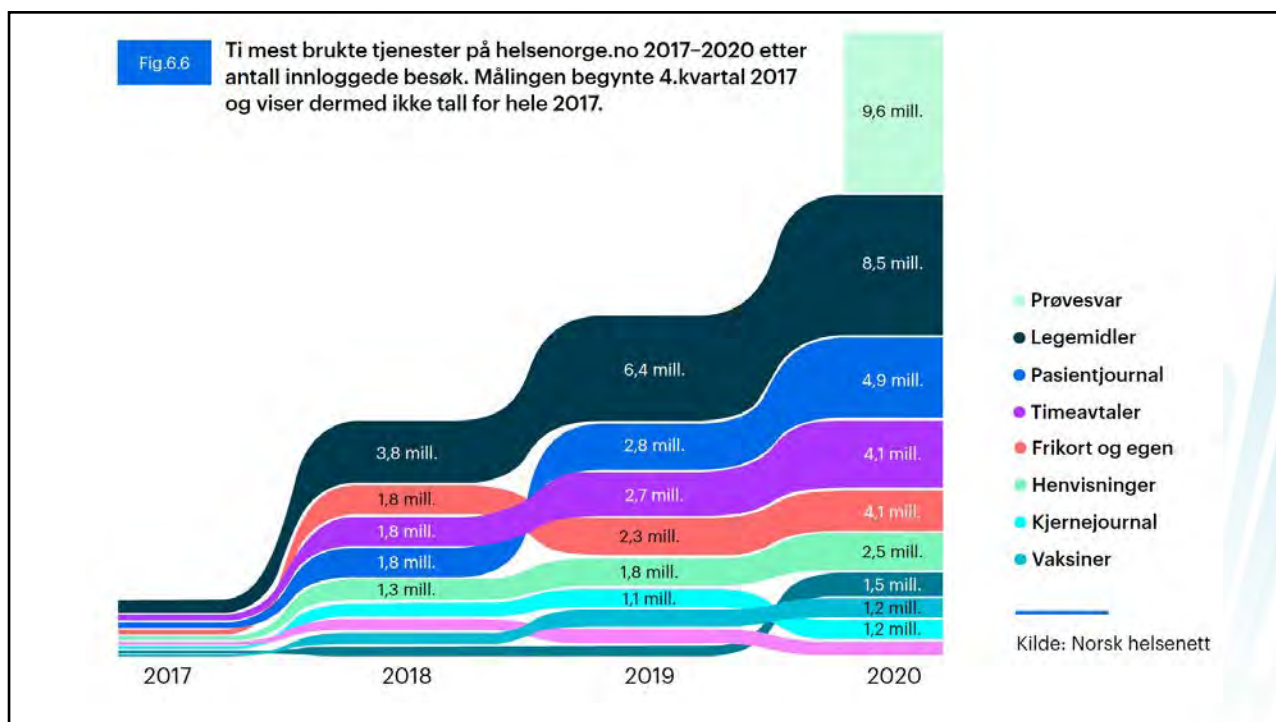
**80 % av befolkningen**

har en aktiv bruker på helsenorge.no

Totalt antall innlogginger  
på helsenorge.no var cirka  
**43 millioner**  
i 2020, og er mer enn doblet fra 2019.

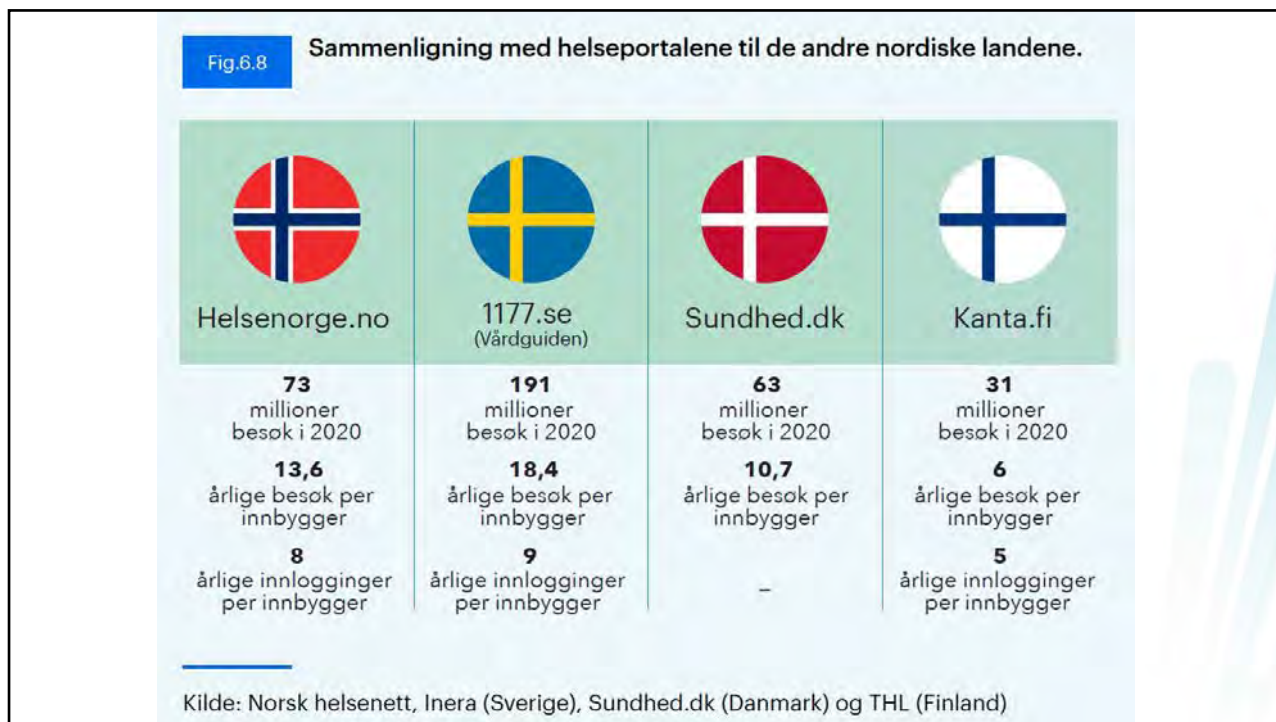
Dette tilsvarer omtrent  
**8 innlogginger**  
per innbygger.

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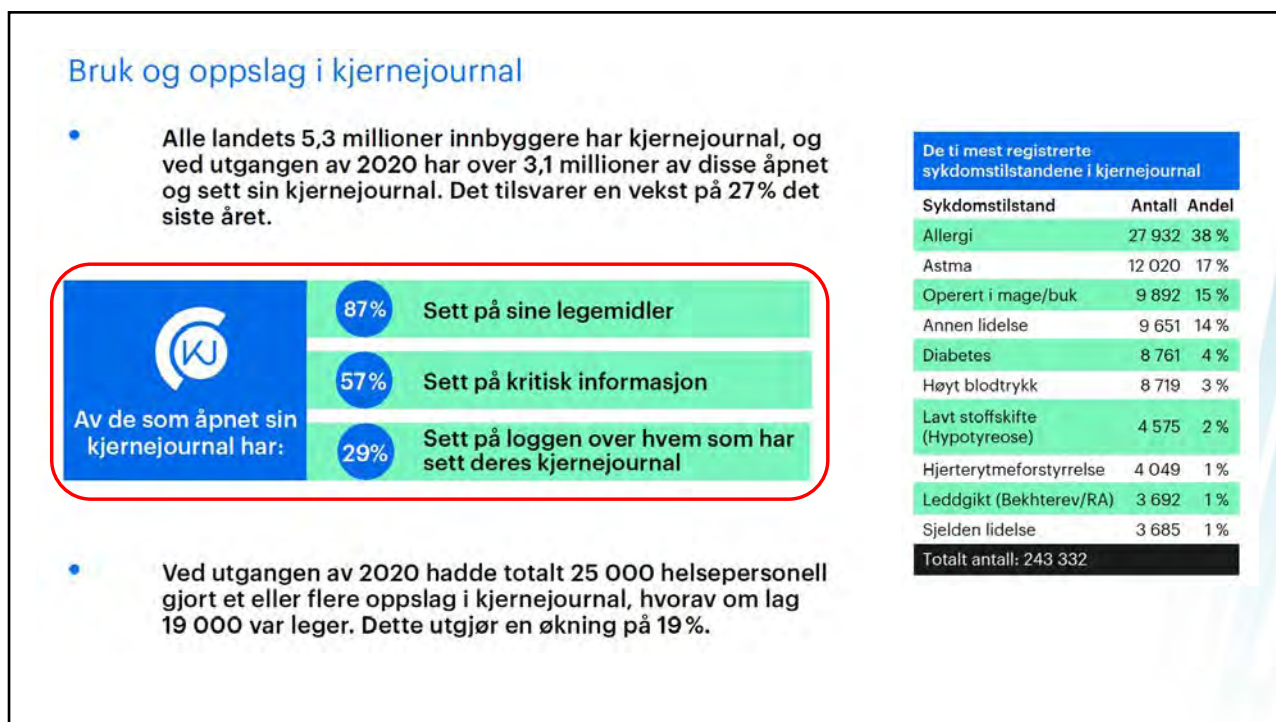


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# **Internasjonalt**

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# **NHS (UK) SINE PLANER**

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## The Topol Review

«I 2018 feirer NHS sitt 70-årsjubileum. Selv om det er vanskelig å forutsi fremtiden, vet vi at **genomics, digital medisin, kunstig intelligens** og **robotteknologi** vil få en enorm innvirkning på pasienter og helsearbeidere i løpet av de kommende to tiår.»



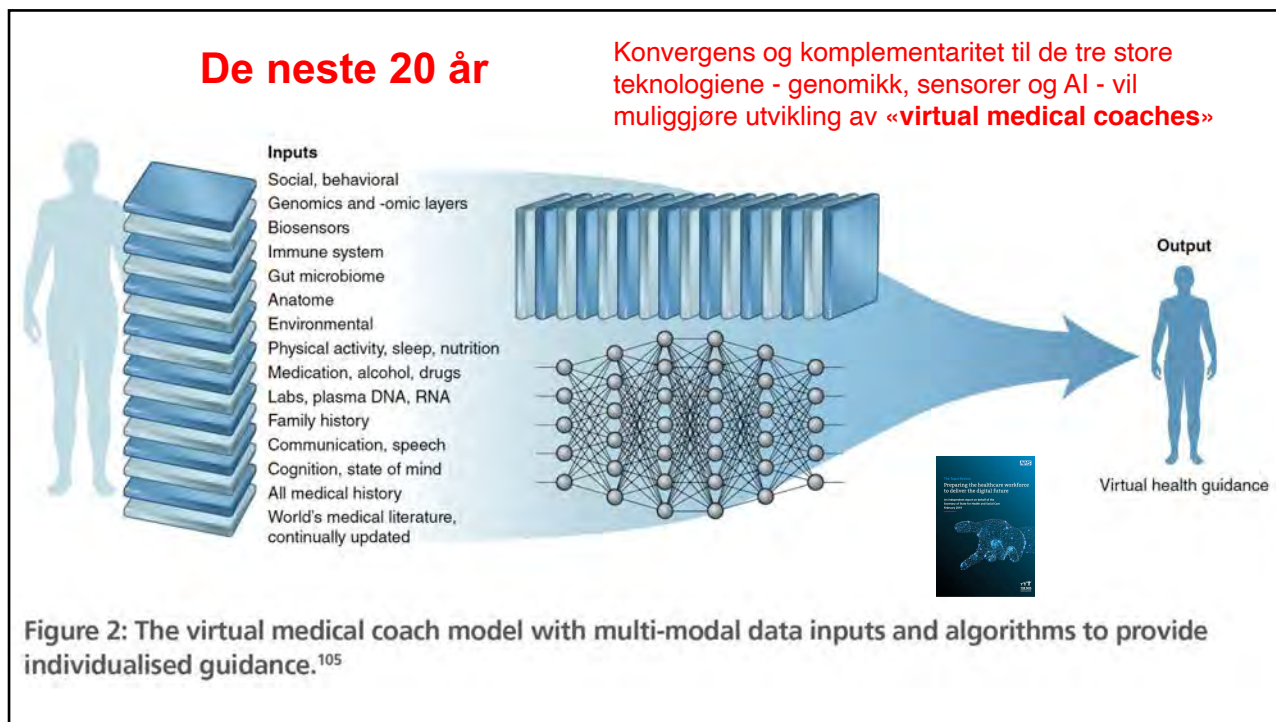
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## Digital medisin

«Nye digitale teknologier har potensialet for å transformere hvordan NHS leverer omsorg i tiårene som kommer, for eksempel gjennom raskere og mer pålitelig diagnose av smittsomme sykdommer, muliggjøre at pasienter selv kan overvåke og administrere egen helse, fremme av helse og velvære gjennom personaliserte apper, og levere omsorg utenfor tradisjonelle helsetjenester gjennom medisinsk avstandsoppfølging.»



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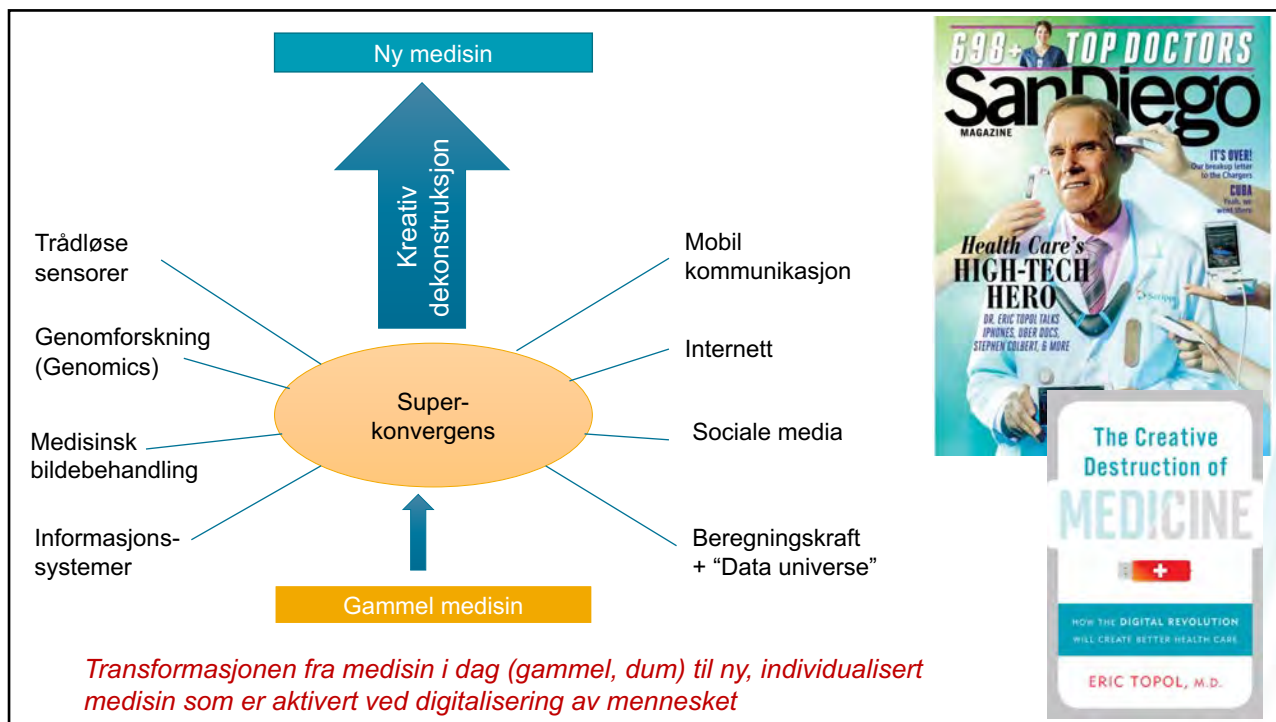
## The Wachter Report

"Til de av dere som lurer på om NHS har råd til en ambisiøs innsats for å digitalisere i dagens miljø av nøysomhet og et utall av løpende utfordringer, tror vi svaret er klart: **den eneste tingen NHS ikke har råd til å gjøre, er å forbli et i hovedsak ikke-digitalt system. Det er på tide å fortsette med IT.**"

**Making IT Work:**  
**Harnessing the Power of Health Information Technology to Improve Care in England**  
 Report of the National Advisory Group on Health Information Technology in England

Robert M. Wachter, MD, Chair


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**Det neste store målet innen helse(?)**

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IMPROVING  
DIAGNOSIS IN  
HEALTH CARE

QUALITY CHIASM SERIES  
The National Academies of  
SCIENCES • ENGINEERING • MEDICINE

«Improving Diagnosis in Health Care» avslører en type kritiske feil i helsevesenet – diagnostiske feil – som har fått relativt lite oppmerksomhet siden utgivelsen av «To Err Is Human» i år 2000

450 sider (2015)



TO ERR IS HUMAN  
BUILDING A SAFER HEALTH SYSTEM  
INSTITUTE OF MEDICINE

287 sider (2000)

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# Nordnorsk pionervirksomhet

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## Nord-Norske miljø var først ...

- 1975: DPF-prosjektet (Datatekniske metoder i primær og forebyggende helsetjeneste) (UiT)
- 1981: Elektronisk pasientjournalssystem (Balsfjordsystemet) (UiT)
- 1987: DIPS tatt i bruk ved Nordlandssykehuset
- 1988: Telemedisin (UNN)
- 1992: Helsenett (startet med røntgenavd. UNN)
- 2005: Master i telemedisin og e-helse (UiT)
- 2007: SFI innen telemedisin og e-helse (UNN, UiT, m.fl.)
- 2016: e-helse (UNN)
- 2018: Siv.ing. helseteknologi (UiT)

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1975: Datatekniske metoder i primær og forebyggende helsetjeneste

- **PROSJEKT:** *Datatekniske metoder i primær og forebyggende helsetjeneste*
  - **Professor Knut Skog**, prosjektleder
  - **Balsfjordsystemet** (Distriktslege Balsfjord T.Hasvold)
  - **SDS** (System for dataregistrering og statistikk) (Distriktslege Alta J.I. Kvamme)
  - **Tram** (TekstRedigering, Arkivering og Maskinskrivning) (Kai A. Olsen)



Knut Skog (1936-2018)



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## 1987: DIPS (Distribuert Informasjons- og Pasientdatasystem i Sykehus)

- DIPS tatt i bruk ved Nordland sentralsykehus i Bodø
- "På midten av 80-tallet ønsket Nordland Sentralsykehus i Bodø seg et system som kunne løse behovet for et moderne pasientadministrativt datasystem." (dips.no)
- Tor Arne Viksjø, Trond Hjortdal (IT-avd)



Foto: Medisinsk poliklinikk, Nordlandssykehuset, ca 1989.

Tor Arne ble utdannet Cand. mag. i datafag fra UiT



(1954-2019)

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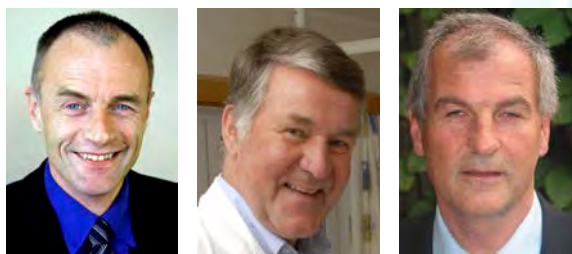
## 1988: Telemedisin

- 1988: Televerkets forskningsinstitutt etablerte avdeling i Tromsø
- 2003: Telemedisinsk avdeling, RiTø
- Bjørn Engum, Steinar Pedersen, Knut Schrøder m.fl.



Demonstrasjon av telemedisin (videokonferanse).

Fra venstre:  
Steinar Pedersen, Knut Schrøder, Bjørn Engum



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TEK.NO GAMER TU DIGI.NO TU JOBB INSIDE TELECOM PRISGUIDE DISKUSJON ARRANGEMENTER Om innkøper

**TEK.NO**

**PORTRETT**

Jeg liker nok å være den som tar å tenke annerledes, forteller Steinar Pedersen. Foto: Knut Schrøder

**Han revolusjonerer norsk helsevesen med teknologi**

Steinar Pedersen er Norges ukjente teknologiprofet.

AV STEIN W. HØIE 25. april 2013 - 06:09

KOMMENTARER (3)


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**HealthBlog**  
Thoughts, comments, news, and reflections about healthcare IT from Microsoft's worldwide health senior director Bill Cr...

MSDN Blogs > HealthBlog > Soaring to New Heights in Telemedicine and eHealth

**Soaring to New Heights in Telemedicine and eHealth**

hthblog 9 Jun 2008 4:37 AM 2



I am writing this from Tromsø, Norway, where later today I will deliver a keynote address at the **Tromsø Telemedicine and eHealth Conference**. Preceding me on stage is Dr. Clayton Christensen of Innovator's Dilemma fame. I believe my message on healthcare delivery

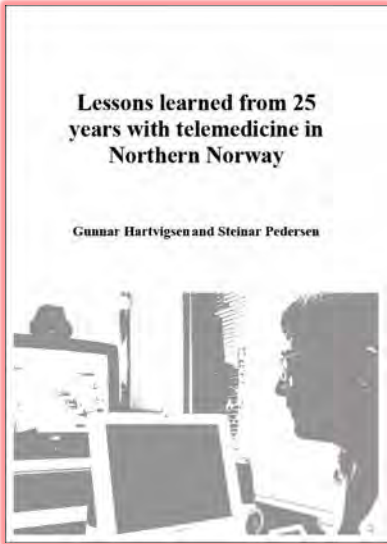

Information is available everywhere and cell phones can be used for everything, even to health care, says Dr. Bill Crouse of Microsoft's worldwide health. Photo: Jan Fredrik Frantzen.

„This might be the last place you would expect to find an internationally renowned research center for telemedicine and e-health but that is exactly what is here. Tromsø is home to the internationally recognized Norwegian Center for Telemedicine, chaired by Dr. Steinar Pedersen.“

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**Bok**

*“Lessons learned from 25 years with telemedicine in Northern Norway” (405 pages)*

<http://hdl.handle.net/10037/8967>

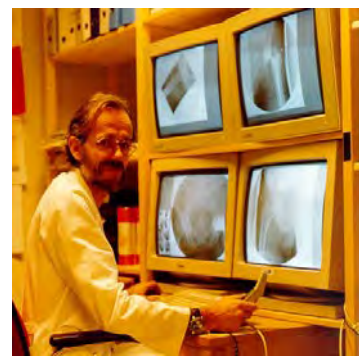
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# 1992: Nordnorsk Helsenett

- Behovet for helsenett fremkom gjennom etablering av teleradiologi ved RiTØ (1992)
- Overlege Jan Størmer var drivkraften
- Sture Pettersen ved TMA, RiTØ, utarbeidet planene for et Nordnorsk helsenett



Sture Pettersen, RiTØ



Jan Størmer, RiTØ

**NRK Troms**

## (2002) Åpnet helsenett

I Tromsø åpna statsminister Kjell Magne Bondevik i dag Nordnorsk Helsenett. Dette er et tilbud til legekantorene i Nord-Norge, hvor leger og sykehus kommunisere elektronisk.

**Leder for Nordnorsk Helsenett Morten Amundsen sier dette er en revolusjon for legekantorene, og at Tromsø er først ut med dette tilbudet på verdensbasis.**

Oppdatert 30.05.2002, kl. 15:51

# 2005: Master i telemedisin og e-helse

- 2-årig
- Engelsk (internasjonal MSc)
- 2 retninger (helse, teknologi)



Master students in the telemedicine program at the University of Tromsø further develops the open source code in the computer system PasientLink. From left Kent Ove Josefsen from Norway, Sanjay from Nepal and Joe Hurley from the USA. Photo: Jan Fredrik Frantzen, NST.



Nyutdannede telemedisinere klare for nye utfordringer. Foto: Jan Fredrik Frantzen



# Dyktige studenter

- Studentene holdt et høyt faglig nivå
- 1. plass i IBMs Extreme Blue Project 2011 i konkurranse med studenter over hele Europa

**Smarter Healthcare - Extreme Blue Project 2011**

**RT-DiSM**  
Real-Time Disease Surveillance and Management

Logos for University of Tromsø, Tromsø Telemicine Laboratory, and IBM Business Solution Center La Gaude.

Sunday Oluwafemi Oyeyemi, Kassaye Yitbarek Yigzaw, Thomas Brechet, Xiajing Tang, Papa Samba Sy

IBM Global HC CoE @ La Gaude - August 2011 © 2011 IBM Corporation

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# 2007-2015: Tromsø Telemedicine Laboratory (SFI, NFR)



Gunnar Hartvigsen  
Senterleder

Forside | English Logg inn | Kalender | Nettkart | Ansatte

**Norges forskningsråd**

Søknader og rapportering Fag og programmer Næringsliv Internasjonalt Forskningspolitikk Publikasjoner Norges forskningsråd

Her er du: > Fag og programmer > Sentre: SFF SFI > Sentre for forskningsdrevet innovasjon (SFI)

**Fag og programmer**  
Sentre: SFF SFI

**14 nye elitesentre**  
Publisert: 16.06.2006  
Sist oppdatert: 19.06.2006

**Norge får nå 14 sentre for forskningsdrevet innovasjon (SFI). Ordningen er et krafttak for å styrke samarbeidet mellom sterke forskningsmiljøer og allerede forskningsaktive bedrifter.**

**Sentrene**  
Sentre - liste (pdf)  
Sentre for forskningsbasert innovasjon (ppt) - Hvem er de?

**Sentre for forskningsbasert innovasjon (SFI)**  
SFI-ordningen har til hensikt å bygge opp eller styrke norske forskningsmiljøer som arbeider tett sammen med innovativt næringsliv. Formålet er å støtte langsiktig forskning som fremmer innovasjon og næringslivets konkurransekraft.

**Kontakt**  
Dag Kavlie  
Prosjektleder  
tlf. 22 03 73 61  
Dagrun Pedersen  
Konsulent  
tlf. 22 03 72 93

Bakgrunn  
Kjøreplan  
Dokumenter  
Grafisk profil  
Nyhetsarkiv

Kunnskapsminister Øystein Djupedal presenterte fredag 16. juni de fjorten nye forskningssentrene. Foto: Arne Langleite.

Fredag 16. juni offentliggjorde kunnskapsminister Øystein Djupedal sammen med næringsminister Odd Eriksen hvem som er vinnere i konkurransen om å bli et SFI. Av 58 søkergrupper som har konkurrert, ble 14 valgt ut. Forskningsrådets hovedstyre besluttet dette på sitt møte sist torsdag.

- Jeg forventer at denne ordningen vil bidra til økt forskningsinnsats i næringslivet, og til at bedriftene investerer mer langsiktig i forskning. Ikke minst vil den styrke kontakten mellom fremragende forskningsmiljøer i akademis og næringslivet. Dette er viktig for å bygge kunnskap og kompetanse som kan sikre velferd og økonomisk vekst, sier Øystein Djupedal.

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2007:  
Tromsø Telemedicine Laboratory (SFI, NFR)

## Vision TTL



To become a world leading centre for research and innovation in the field of advanced telemedicine and eHealth systems for chronic, age, and lifestyle related diseases.

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2007:  
Tromsø Telemedicine Laboratory (SFI, NFR)

## Aktivt samarbeide

Aktivt samarbeide = joint publications



Mål: samarbeide med verdens beste fagmiljø

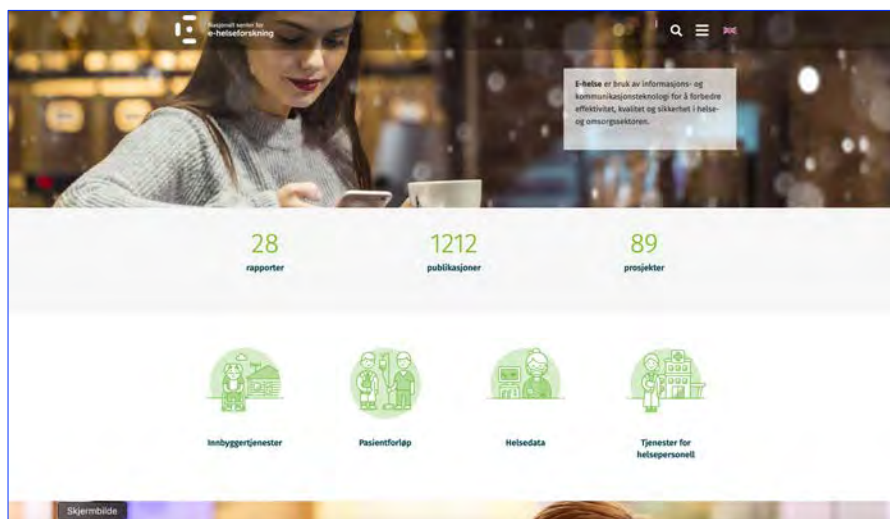
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## 2016: e-helse (UNN)

**Nasjonalt  
senter for  
e-helseforskning**

**Etablert: 2016**

**Ca. 90 ansatte**



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## 2018: Siv.ing. helseteknologi

UiT/ NORGES ARKTISKE UNIVERSITET

Velkommen til Institutt for informatikk

Forsiden | Utdanning | Forskning | Aktuelt | Ansatte ved IFI | Om instituttet

**Institutt for Informatikk (IFI)**

Informatikk UiT Mitt Yrke NRK

Velkommen nye informatikkstudenter!

Høsten 2018 starter vi en ny og unik studieretning i Norge - Helseteknologi (siv/ingeniør/interoper master i informatikk)

Har din bedrift lyst til å holde bedriftspresentasjon/ workshop for våre informatikkstudenter eller ha samarbeid med IFI?

**TILKNYTTETE ENHETER:**

Fakultet for naturvitenskap og teknologi

Kontakt oss gjerne!  
 Telefon: +47 776 44056  
 E-post: administrasjon.ifi@uit.no

Institutter ved NT-nak:

- Dynamisk og teknologisk
- Geometri
- Informatikk
- Ingeniør- og sikkerhet
- Kjemt
- Matematikk og statistikk

Publikasjoner ved IFI:

Cristin

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## 2022: Erfaringsbasert master i digitale helsetjenester

Målgruppen er helsepersonell og ansatte innen helsesektoren som ønsker å øke sin kompetanse innen dette området.

Studiet har 50% studieprogresjon og er tilrettelagt for studenter som arbeider ved siden av studiet.

Studentene gis en grundig forståelse for teknologiens muligheter og begrensninger relatert til digitale helsetjenester.

Studentene lærer å **bidra i implementerings- og innovasjonsprosjekter**, og vil opparbeide seg **bestillerkompetanse relatert til digitale helsetjenester**.

**Masterprogrammet er lokalisert til UiTs campus Helgeland** og gjennomføres i tett samarbeid med Helgelandssykehuset og kommunene på Helgeland – region Helgeland, slik at det blir i tråd med arbeidslivets behov, både på kort og lang sikt.

Studentene arbeider med **konkrete problemer og behov innen helsetjenesten i region Helgeland**.



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## Nord-Norge har – fortsatt –

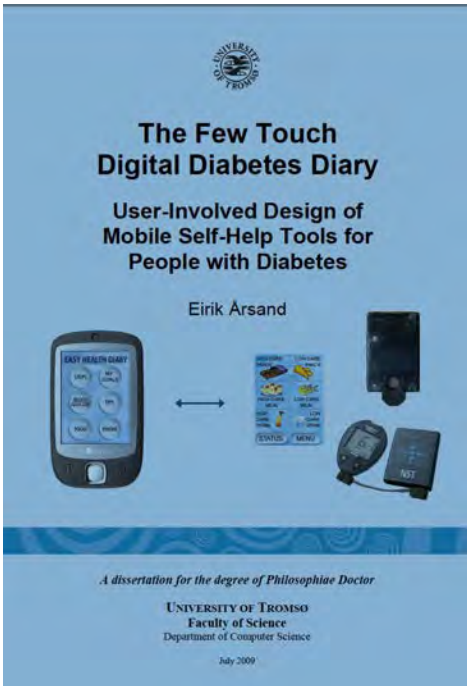
**Norges største forskningsmiljø innen helse og IKT (samlet på campus Breivika i Tromsø)**

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# ET PAR EKSEMPLER FRA VÅR EGEN FORSKNING

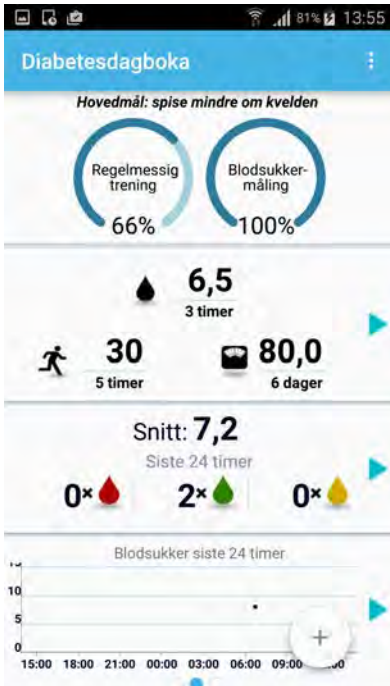
Verdens diabetesdag 14. november

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**The Few Touch Digital Diabetes Diary**  
User-Involved Design of Mobile Self-Help Tools for People with Diabetes  
Eirik Arsand

*A dissertation for the degree of Philosophiae Doctor*  
UNIVERSITY OF TROMSØ  
Faculty of Science  
Department of Computer Science  
July 2009



**Diabetesdagboka**

Hovedmål: spise mindre om kvelden

Regelmessig trening: 66%

Blodsukkermåling: 100%

6,5 (3 timer)


30 (5 timer) | 80,0 (6 dager)

Snitt: 7,2 (Siste 24 timer)

0x (red), 2x (green), 0x (yellow)

Blodsukker siste 24 timer

**Eksempel på forskning som har blitt tatt i bruk av tusenvis av pasienter ...**



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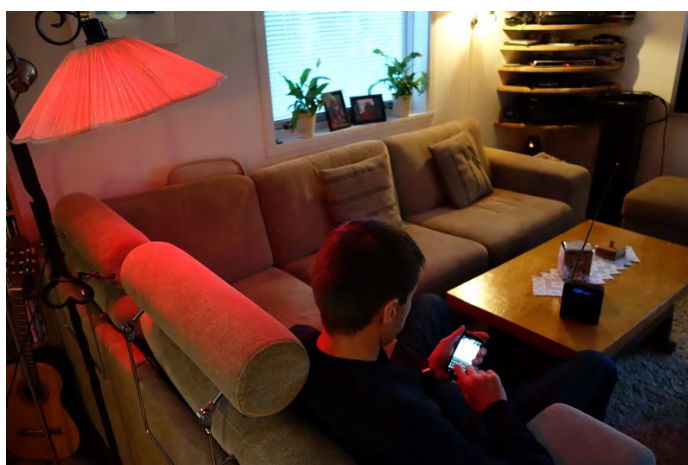
## Eksempel: Kommunikasjon barn - foreldre

Tradisjonell  
blodsuktermåling



**Barn med type 1 diabetes**

Løsningen fungerer også med  
en kontinuerlig blodsuktermåler



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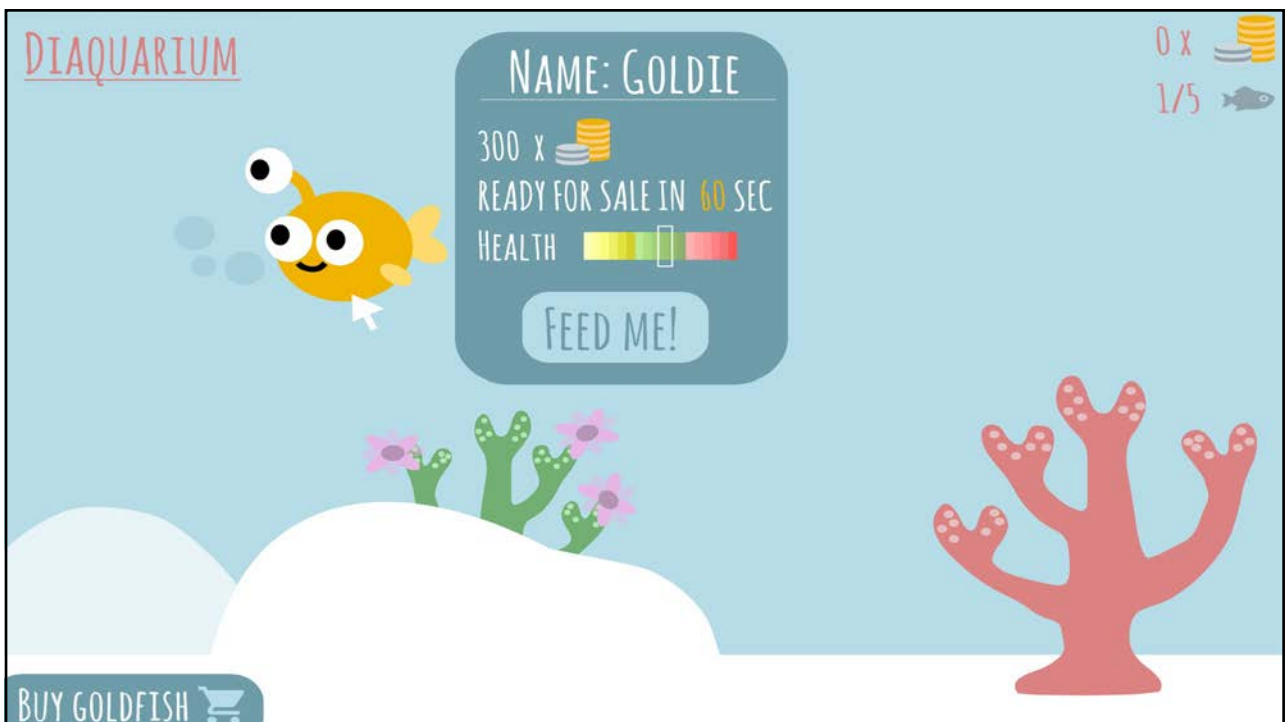
<https://www.youtube.com/watch?v=qqOAFMwz8RY&t=7s>



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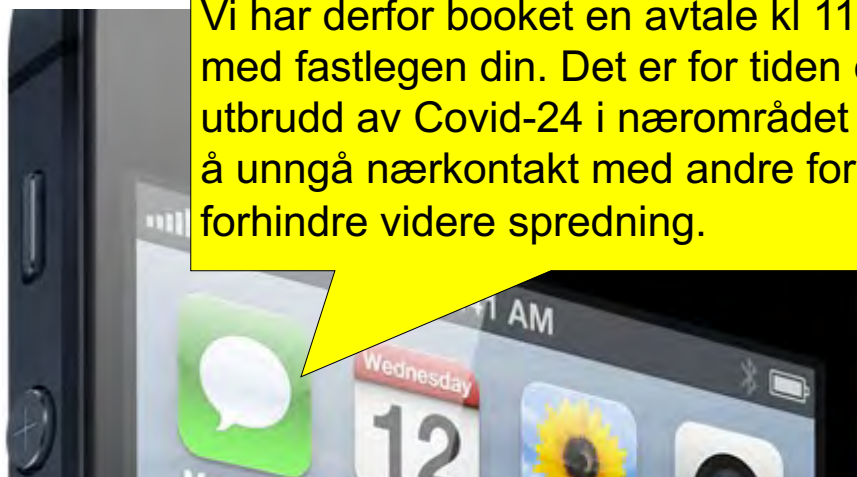


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## Kombinasjon av sensorbasert og syndromisk monitorering

Du har en infeksjon. Vennligst kontakt lege. Vi har derfor booket en avtale kl 11:30 i dag med fastlegen din. Det er for tiden et utbrudd av Covid-24 i n romr det ditt. Pr v   unng  n rkontakt med andre for   forhindre videre spredning.



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## Disease surveillance

**To detect the spread of contagious diseases before the people infected know that they are infected.**

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**Conclusions:** We presented the effect of infection incidence on key parameters of blood glucose dynamics along with the necessary framework to exploit the information for realizing a digital infectious disease detection system. The results demonstrated that compared with regular or normal days, infection incidence substantially alters the norm of blood glucose dynamics, which are quite significant changes that could possibly be detected through personalized modeling, for example, prediction models and anomaly detection algorithms. Generally, we foresee that these findings can benefit the efforts toward building next generation digital infectious disease detection systems and provoke further thoughts in this challenging field.

Woldaregay, A.Z., Launonen, I.K., Årsand, E., Albers, D., Holubová, A., Hartvigsen, G. Towards Detecting Infections Incidence in People with Type 1 Diabetes Using Self-Recorded Data (Part 1): A Novel Framework for a Personalized Digital Infectious Disease Detection System. *Journal of Medical Internet Research* 2020;22(8):e18911. DOI: 10.2196/18911\_PMD: 32784178

JOURNAL OF MEDICAL INTERNET RESEARCH

Woldaregay et al

Original Paper

**Toward Detecting Infection Incidence in People With Type 1 Diabetes Using Self-Recorded Data (Part 1): A Novel Framework for a Personalized Digital Infectious Disease Detection System**

Achewale Zelene Woldaregay<sup>1</sup>, MSc; Ilika Kallio Launonen<sup>2</sup>, PhD; Erik Årsand<sup>3</sup>, PhD; David Albers<sup>4</sup>, PhD; Anna Holubová<sup>5</sup>, MSc; Gunnar Hartvigsen<sup>6</sup>, PhD

<sup>1</sup>Department of Computer Science, University of Eastern Finland, The Arctic University of Finland, Rovaniemi, Finland; <sup>2</sup>Department of Clinical Research, University Hospital of South Norway, Trondheim, Norway; <sup>3</sup>Department of Pediatric, Adolescent and Family Science, University of Toronto, Toronto, ON, Canada; <sup>4</sup>Department of Biomedical Informatics, Columbia University, New York, NY, United States; <sup>5</sup>Department of ICT in Medicine, Faculty of Health and Behaviour, Umeå University, Umeå, Sweden; <sup>6</sup>Department of Cancer and Health, Cancer Communication Center of the First Faculty of Medicine, Charles University, Prague, Czech Republic

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**Abstract**

**Background:** Type 1 diabetes is a chronic condition of blood glucose metabolic disorder caused by a lack of insulin secretion from pancreatic cells. In people with type 1 diabetes, hyperglycemia often occurs upon infectious incidences. Despite the fact that patients increasingly gather data about themselves, there are no valid findings that uncover the effects of infectious incidences on key parameters of blood glucose dynamics to support the effective treatment of developing a digital infectious disease detection system.

**Objective:** The study aims to retrospectively analyze the effects of infection incidence and propose optimal parameters that can effectively be used to input variables for developing an infection detection algorithm and to provide a general framework regarding how a digital infectious disease detection system can be designed and developed using self-recorded data from people with type 1 diabetes as a secondary source of information.

**Methods:** We retrospectively analyzed high-precision self-recorded data of 10 patient-years captured within the longitudinal records of three people with type 1 diabetes. (Primary each a child and large data set from a large number of participants to extensively explore and difficult to acquire, if not impossible. The data set encompasses blood glucose, insulin, carbohydrate, and self-reported events of infections. We investigated the temporal evolution and probability distributions of the key blood glucose parameters within a specified timeframe (weekly, daily, and hourly).

**Results:** The analysis demonstrated that upon infection incidence, there is a dramatic shift in the operating point of the individual blood glucose dynamics in all the parameters (weekly, daily, and hourly), which clearly violates the usual norm of blood glucose dynamics. During regular or normal situations, higher insulin and reduced carbohydrate intake usually result in lower blood glucose levels. However, in all infection cases as opposed to the regular or normal days, blood glucose levels were elevated for a prolonged period despite higher insulin and reduced carbohydrate intake. For instance, compared with the preinfection and postinfection weeks, on average, blood glucose levels were elevated by 15% and 18%, insulin (total) was increased by 42% and 39.3%, and carbohydrate consumption was reduced by 39% and 28.1%, respectively.

**Conclusions:** We presented the effects of infection incidence on key parameters of blood glucose dynamics along with the necessary framework to exploit the information for realizing a digital infectious disease detection system. The results demonstrated that compared with regular or normal days, infection incidence substantially alters the norm of blood glucose dynamics, which are quite significant changes that could possibly be detected through personalized modeling, for example, prediction models and

XSL-FO

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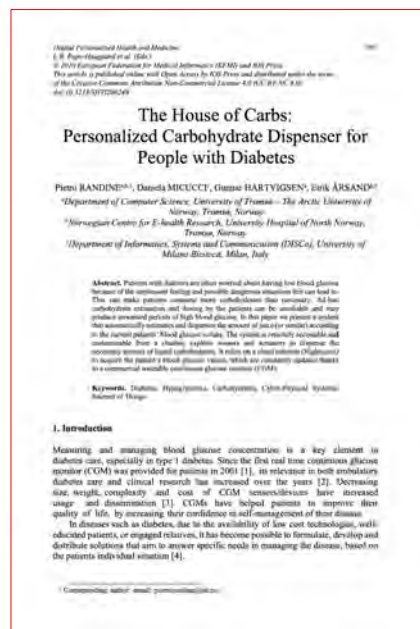
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**Conclusions:** We demonstrated the applicability of one-class classifiers and unsupervised models for the detection of infection incidence in people with type 1 diabetes. In this patient group, detecting infection can provide an opportunity to devise tailored services and also to detect potential public health threats. The proposed approaches achieved excellent performance; in particular, the boundary and domain-based method performed better. Among the respective groups, particular models such as one-class support vector machine, K-nearest neighbor, and K-means achieved excellent performance in all the sample sizes and infection cases. Overall, we foresee that the results could encourage researchers to examine beyond the presented features into other additional features of the self-recorded data, for example, continuous glucose monitoring features and physical activity data, on a large scale

Woldaregay, A.Z., Launonen, I.K., Albers, D., Iguar, J., Årsand, E., Hartvigsen, G. A Novel Approach for Continuous Health Status Monitoring and Automatic Detection of Infection Incidences in People With Type 1 Diabetes Using Machine Learning Algorithms (Part 2): A Personalized Digital Infectious Disease Detection Mechanis. *Journal of Medical Internet Research* 2020;22(8):e18912. DOI: 10.2196/18912 PMID: 32784179



# House of Carbs





<https://www.youtube.com/watch?v=-f2rK3T6SvE>

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**What motivates patients with NCDs to follow up their treatment?**

\*Anika HERSKOVIC<sup>1</sup>, Adnanović, Adnanović, WILHELMINA<sup>2</sup>, Damić, Damić, ISMIR, Kamil, KATOP, Fik, ADELALI<sup>3</sup>, Mujib, MUJIB, Ali, Ali, PPTI<sup>4</sup>, Ibrahim, ILMALATI<sup>5</sup>, Gani, GANI, PANGOLAN<sup>6</sup>

<sup>1</sup>Dept. of Informatics, Faculty of Science, University of Sarajevo, Sarajevo, Bosnia and Herzegovina; <sup>2</sup>The Faculty of Science, University of Sarajevo, Sarajevo, Bosnia and Herzegovina; <sup>3</sup>The Faculty of Science, University of Sarajevo, Sarajevo, Bosnia and Herzegovina; <sup>4</sup>Department of Informatics, Faculty of Science, University of Sarajevo, Sarajevo, Bosnia and Herzegovina; <sup>5</sup>Department of Informatics, Faculty of Science, University of Sarajevo, Sarajevo, Bosnia and Herzegovina; <sup>6</sup>Department of Informatics, Faculty of Science, University of Sarajevo, Sarajevo, Bosnia and Herzegovina

**Introduction**

The increasing prevalence of non-communicable diseases (NCDs) has led to a growing need for digital health solutions to support patient self-management and adherence to treatment. This development is supported by an increasing number of available mobile health (mHealth) apps. The apps range from disease management apps (e.g., diabetes, hypertension, asthma) to health and fitness apps (e.g., fitness, diet, and weight management). However, there is still a lack of evidence on how these apps are used in practice and what motivates patients to use them. This study aims to explore the factors that motivate patients to use mHealth apps and to identify the barriers to their use. The study is part of a larger project that aims to develop a digital health solution for NCD patients. The results of this study will be used to inform the design and development of such a solution.

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- Virtual Library (available after the congress)

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**UiT The Arctic University of Norway**

Faculty of Science and Technology  
Department of Computer Science

**Salutem**  
A group-based motivational approach to obtain healthy blood glucose levels for people with diabetes

Joakim Sjøhaug  
INF-3981 Master's thesis in Computer Science June 2021

**mySugar - Diabetes Tracker Log**

Comparison application for Accu-Check Meters that automatically import BG values to the app. The application can log meals, show estimated HbA1c levels, view daily, weekly, and monthly reports about BG levels that the user can share with doctors. The application also has a subscription that enables more features like meal photos, BG reminders, insulin calculator, etc.

**Pros**

- Have a feature to enter glucose levels manually.
- Apple HealthKit integration.
- Estimated HbA1c.
- Daily, weekly and monthly reports.
- Insulin calculator with precise dose recommendations.
- Glucose graphs.
- Custom challenges.

**Cons**

- Only supports Accu-Check® systems.
- Some features are limited to a paid subscription.

**Computers as Tools**

Computer in this role aims to make processes easier to do with the use of technology. An example can be to view the balance of your bank account.

There are seven types of persuasive technology tools [12]:

- **Reduction** - Reducing the number of steps it takes to accomplish a task.
- **Tunneling** - Using visualization or calculations to show when the user is done with something or progresses with a task.
- **Tailoring** - Making the experience more exclusive by customizing it to the user.
- **Suggestion** - Providing suggestions at a suitable time.
- **Self-monitoring** - Use technology to track the progression to a predetermined goal.
- **Surveillance** - Using technology to see other people's progress or performance.
- **Conditioning** - Giving positive feedback when doing a task or behavior.

Each of these tools helps a product be more persuasive towards the user and when creating a product for persuasion, combining two or more of these tools to achieve the desired outcome is typical [12].

Figure 5.3: Application home screen with annotations

Figure 5.5: Profile view of a group member with annotations

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**UiT The Arctic University of Norway**

Faculty of Science and Technology  
Department of Computer Science

**Dynamic ePROM to improve diabetes consultations**  
Incorporating patient-gathered data into ePROMs

Benjamin Aglen  
INF-3981 Master's thesis in Computer Science June 2021

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WARIFA: Watching the risk factors: Artificial intelligence and the personalized prevention and management of chronic conditions

**Description**

WARIFA is a four-year research project funded by the EU's research and innovation programme Horizon 2020. The project is led and coordinated by the Norwegian Centre for E-health Research. The consortium consists of 12 European partners from 6 countries.

**Project managers**

- Conceição Granja
- Thomas Roger Schoof

**Project participants**

- Merethe Drivdal
- Terje Schroll
- Maryam Zayehi Nasrabadi
- Phuong Binh Ngo
- Kari Dyb
- Meghan Bradley
- Inger Torhild Gram
- Monika Johansen
- Stein Olav Skjerve

**Collaborating organisations**

- Melanomforeningen
- UiT The Arctic University of Norway
- Universitetet i Oslo
- Universitatea de medicina si Farme Carol Davila din Bucuresti, Romania
- UiT Norges arktiske universitet
- Universidad de Las Palmas de Gran Canaria, Spain
- Universitet i Oslo
- Munster Technological University, Ireland
- CiaoTech Srl, Italia
- Netsun Software S.R.L., Romania
- Consiglio Nazionale delle Ricerche, Italia
- Universidad Rey Juan Carlos, Spain
- Sensotrend OY, Finland
- Melanomforeningen, Norge

**Financing**

- EU

**Theme**

Citizen services

Stein Olav Skjerve, Conceição Granja, Merethe Drivdal and Thomas Schoof from the Norwegian Centre for E-health Research is coordinating the WARIFA project. Photo: Jan-Silvan Olsen

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## WARIFA

- WARIFA - **W**atching the **r**isk **f**actors: Artificial Intelligence (AI) and the prevention of chronic conditions – is a research project funded by EU's research and innovation programme Horizon 2020 (GA 101017385).
- The primary goal is to define a **general personalised early risk assessment tool** that will be used to support individual preventive measures for noncommunicable diseases, such as cardiovascular diseases, cancer, chronic respiratory diseases and diabetes, the leading causes of death in the world.
- This system will be accessible for individual citizens and patients on their smartphone via the WARIFA app.
- The AI based technology developed in the project could also be embedded in other third-party apps in the near future.

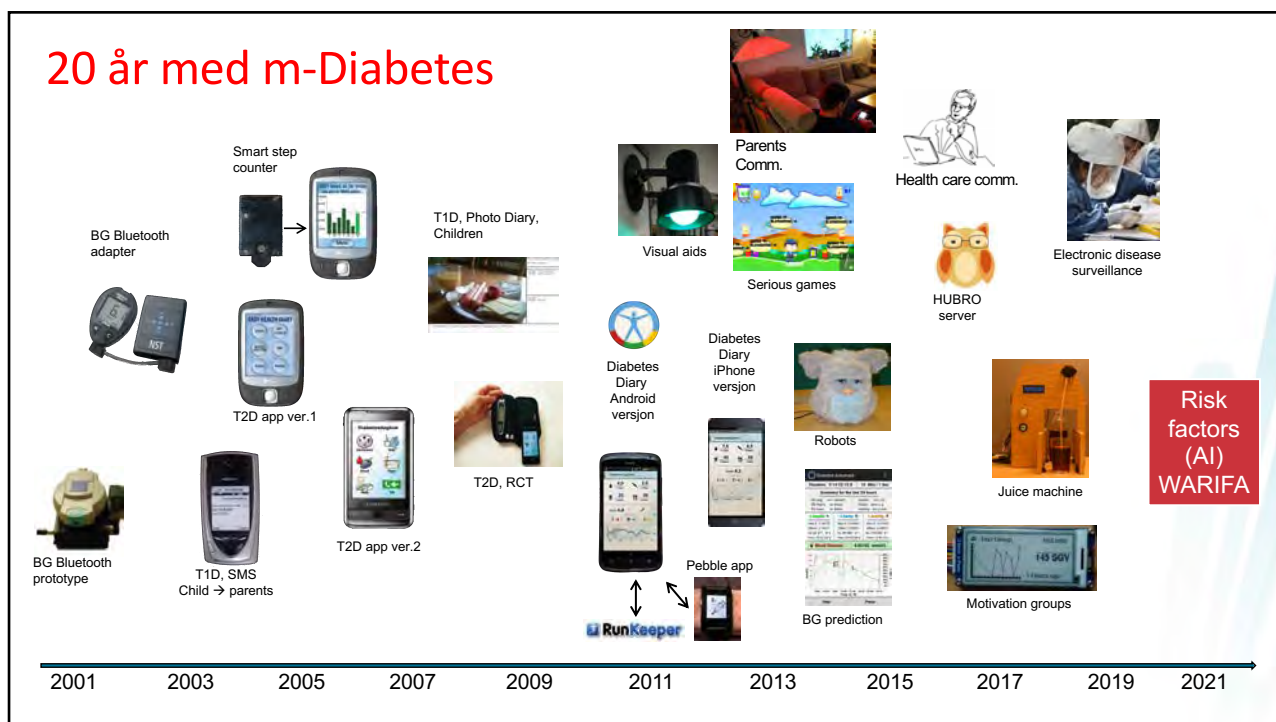
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# WARIFA

- Thanks to this risk assessment tool based on automatic processing of both user-generated and big data stored in a central system, citizens will be informed about the risk of developing a certain disease which they previously may not have been aware of, or about a known disease getting worse.
- A special feature of the WARIFA tool will be the possibility to advise citizens who are at risk of getting several diseases at the same time.
- Recommendations addressing the different diseases will be merged and balanced in order to avoid conflicting advice.

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## Forskningsbarometeret 2016

Da kunnskapsminister Torbjørn Røe Isaksen i mai 2016 presenterte "Forskningsbarometeret 2016" var det tre forskningsområder innen medisin og helse i Norge han berømmet for sin forskningsinnsats:

**kreftforskningen i Norge, utviklingen av vaksine mot ebola-viruset og satsningen i Tromsø på m-helse innen diabetes.**



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### "Historien om diabetes: forskning, framskritt og forbund"

setter søkelyset på alt som har skjedd på diabetesfeltet fra 1948 til i dag - med et spesielt fokus på diabetesforskning. Boka inneholder populærvitenskapelige artikler skrevet av Norges fremste diabetesforskere.



<https://www.diabetes.no/nettbutikk/tillitsvalgte/jubileumsbok-historien-om-diabetes/>

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# Closed loop

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Endocrinology > Type 1 Diabetes

## Endo Apps: The DIY Artificial Pancreas

— Type 1 diabetics and their parents find solutions for closed-loop control.

by Johnson Thomas MD April 6, 2015



I recently saw a 35-year-old type 1 diabetic patient who is on an insulin pump. While talking about the future of diabetes management, I mentioned the artificial/bionic pancreas project.

She smiled at me and said, "About 16 years ago, when diagnosed with diabetes for the first time, I was told that I will be wearing an artificial pancreas in a few years. It never happened."

<https://www.medpagetoday.com/endocrinology/type1diabetes/50839>


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Endocrinology > Type 1 Diabetes

## Endo Apps: The DIY Artificial Pancreas

— Type 1 diabetics and their parents find solutions for closed-loop control.

by Johnson Thomas MD April 6, 2015



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<https://www.medpagetoday.com/endocrinology/type1diabetes/50839>

**TECH & SCIENCE**

## Artificial Pancreas for Diabetics Seeks FDA Approval

BY ANTHONY CUTHBERTSON ON 6/30/16 AT 10:47 AM EDT




The MiniMed system could help five to 10 percent of people with type 1 diabetes.

MEDTRONIC

<https://www.newsweek.com/artificial-pancreas-diabetics-medtronic-medtech-476275>

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Welcome to Nightscout Setup Guides FAQs Links Map Labs Privacy Nightscout Foundation Contact




# NIGHTSCOUT

## #WeAreNotWaiting

Welcome to Nightscout

### What is the Nightscout project?



Search

#### Disclaimer

All information, thought, and code described here is intended for informational and educational purposes only. Nightscout currently makes no attempt at HIPAA privacy compliance. Use of code from github.com is without warranty or support of any kind. Please review the LICENSE found within

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## Med bukspyttkjertelen rundt livet

Opp og ned i skida, av gårde i full fart med Barbie i hånda, jublende inn i armene til pappa når han henter henne... Silje Hoegheim densen er som seks-åringene flest. Nesten. I et belte rundt livet har hun bukspyttkjertelen som pappa har laget til henne.

**SILJE** Hoegheim har en spesiell bukspyttkjertel som er laget av silikon. Den er som en bukspyttkjertel som pappa har laget til henne.

### Tema Kunstig bukspyttkjertel

Et kan hentes ut som et praktiskampel på «faste nevner» og et trykkes på en av «sluttning bukspyttkjertelen» også å lagre sammenheng eller det minste deilig-varianten. For her er ideene balanserende glukoseproduksjon med i tider.

Men eller:  
 - Har du det bra, kurer pappa Christor Jensen på når han henter henne på SFO er par hundre meter fra skole.  
 - Ja, stråler Silje tilbake i det vakkert utseendet og knoklene som litt til ham for hun leper over til to vinnerne som allerede er i gang med Barbie-rollespill.  
 - Hun er seks år, hun smiler ikke på det, det er litt helt naturlig for henne, smiler pappa og ser etter symbolet.

**PRISER MED**  
 En knapp time tidligere stiller Christor Jensen hjemme. Vidt spikerkortet. Han regner med at Silje allerede er på ute-SFO, slik hun spiller på denne tiden, og via mobiltelefonen sin kan han følge med på hver minste bevegelse i blodglukseret henholdsvis i muskeltangen fra pumpen, gjennomsnittet i blodet, hvor mye karbohydrater hun har spist, når det loop er sist...  
 Og han vet at det går av seg selv. At, hva er trykk på at systemet hun har konstruert holder Siljes bukspyttkjertel godt nok sjekk, og at alarmen går høyt og tydelig hvis noe svikter.  
 Så ser jeg at bakken er sluttet av og hun er på vei ned. 2,4. Han var 2,2 for bare en liten stund siden, og roper hun ut i skolegården og i voldsom aktivitet, smiler han, mens han demonstrerer og forklarer app-en som er kjernen i livet i den kunstige bukspyttkjertelen.

**EN AV TRE I NORGE**  
 Silje Hoegheim Jensen i Alnæs er en av tre i Norge med leddpumpen, og en av cirka 100 globalt, følge de siste tallene Christor Jensen har sagt.



**HVIT DE LANT:** Silje er som andre barna, og vil ikke oppmønstret på seg selv. Silje Hoegheim Jensen i Alnæs er en av tre i Norge med leddpumpen.

Silje, ifølge de andre kan barna betyde:  
 - Vi bruker den gamle Medtronic-pumpen rett og slett fordi den er billigere. Pumpen kan ikke gjøre noe aktivt opp, fordi den ikke kjemper til blodglukseret, så det er Loop-opp som tar alle avgjørelser og stopper bakken når blodglukseret økneren å bli for lavt. Tilsvarende kan den ikke insulinisere når hun økneren å bli for høy. Bukspyttkjertelen være tilsvarende bakken er det full trosskommunikasjon her, og systemet er praktisk, det løser mer enn for den kommer. Det gir en mye bedre behandling, ikke minst for barn som trenger så lite insulin, sier Christor Jensen i Norge.

**INNEBYGGET SIKKERHET**  
 Assosiasjonen til TV-programmet «Åke» har dette hjemme- ligger nok studieretnær for mange når de tenner om feil og programmering, ledning og kobling, algoritmer og kodet, alt for å risere en bedre blodglukseret som kan endre helt galt, for ikke å si last, hvis det ikke gjøres helt riktig eller systemet svikter.

Da den ene overarmen hennes er det festet en CGM (kontinuerlig glukosemåler), en Dexcom CG som er koblet via kablet i Sverige. Til sammen har hun koblet en insulinpumpe, en 60-år gammel Medtronic 715, i kommunikasjonsnettet mellom disse to legger cloud: en spesialskrevet tross kalt Skyline, som blant annet omgir bakstrømskuler til radiospiraler slik at de ulike komponentene kan snakke sammen. Den fjerde bakken i det teknologiske frøstige bukspyttkjertelen er en mobilapp som er en slags foreningstid for Skyline.

I belte rundt livet har Silje en smone med appen Loop, i tillegg til pumpen og Skyline. En tilsvarende app har pappa Christor, mamma Åke og assistentene Bernt og Eivj på Håland. Silje på sine telefoner. Skyline er en liten kortbrett, men pumpen styres bare fra appen.



Diabetes 3/2017 13

## Closed loop experience

From prof. Eirik Årsand's blog


**The pump is trying to kill me!** At least if I follow its feedback to me blindly. So, it did not allow me to enter insulin when my glucose was 14, but when I the next day got a hypo with **“Below 2.2 mmol/L”** – it recommended me to inject 2 units of insulin after I added the carbs to correct the hypo!!

<https://fewtouch.wordpress.com>

**FEBRUARY 3, 2020**

**First experience as an insulin pump user – and with the built-in AI (artificial intelligence)**

After 23 years using an insulin pen, I finally made the big step (for me) starting to use an insulin pump. It is the most advanced pump available in Norway, the **Medtronic 670G** – so called “hybrid closed-loop insulin pump”. I thought this was a good opportunity to enter my thoughts and experiences as a new user to this here in my blog, while I still am new to using a pump. And also to get first-hand experience with AI and cyber-physical systems on my own body – it’s namely also part of my research at UIT and NSE.





Eirik has changed to  
Minimed 780G

He reports that many of  
the «issues» with 670G  
have been solved  
(Current TIR = 90-98%)

**SELF-ADJUSTING BASAL  
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**MINIMED™ 780G INSULIN PUMP**  
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Displays pump & CGM information on a smartphone, with customizable options for alerts.\*\* Patients can easily view their Time in Range data to track their goals.\*\*

**CARELINK™ CONNECT APP**  
Your patients can choose to share their real-time diabetes data with their care partners.\*\*\* Care partners can check glucose values on their phone and get alerts if patients are going high or low.\*\*\*

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## RocketAP automated insulin delivery algorithm shows impressive detection of unannounced meals for better Time in Range

- A small but exciting study showed that a brand-new **automated insulin delivery (AID) algorithm** called **RocketAP** helped adolescents with type 1 diabetes spend more time in range after meals even when they didn't take mealtime (bolus) insulin.
- RocketAP is similar to Control-IQ but with one major difference – **a new system feature that can detect unannounced meals and quickly deliver bolus insulin to avoid post-meal high blood sugar levels (hyperglycemia).**

<https://diatribe.org/latest-news-diabetes-technology---more-attd-2021>

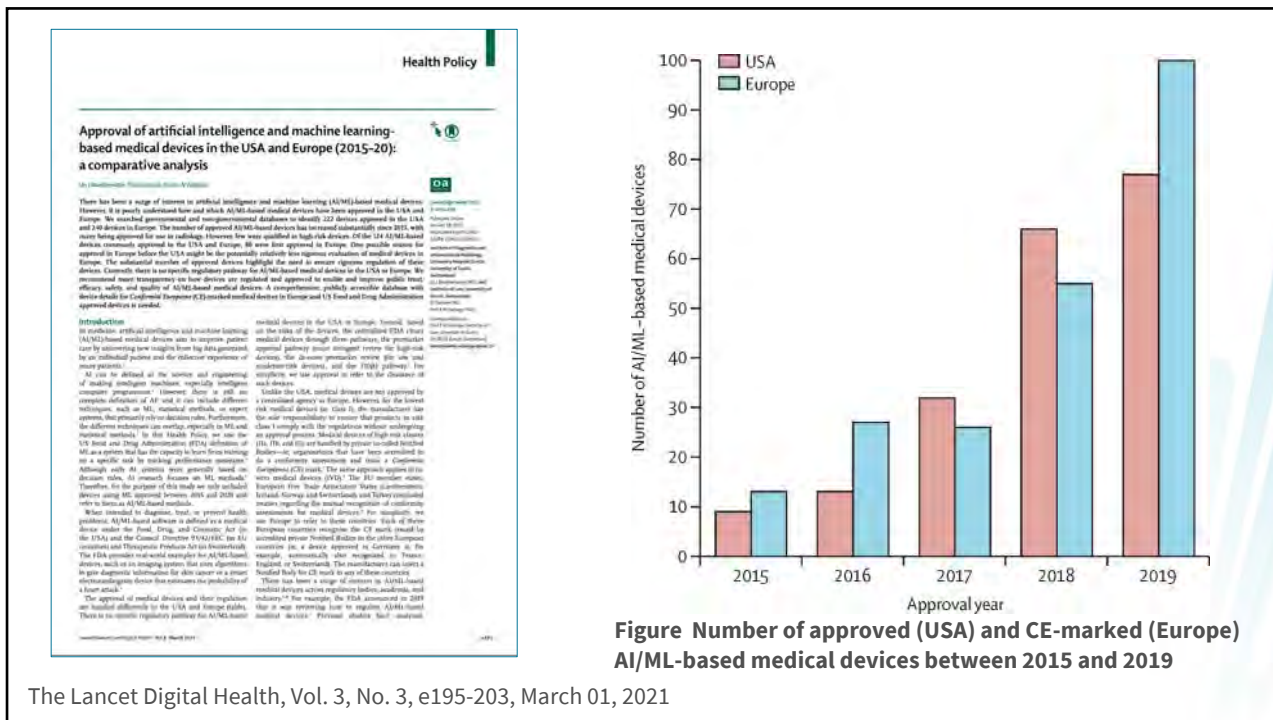
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**AI**

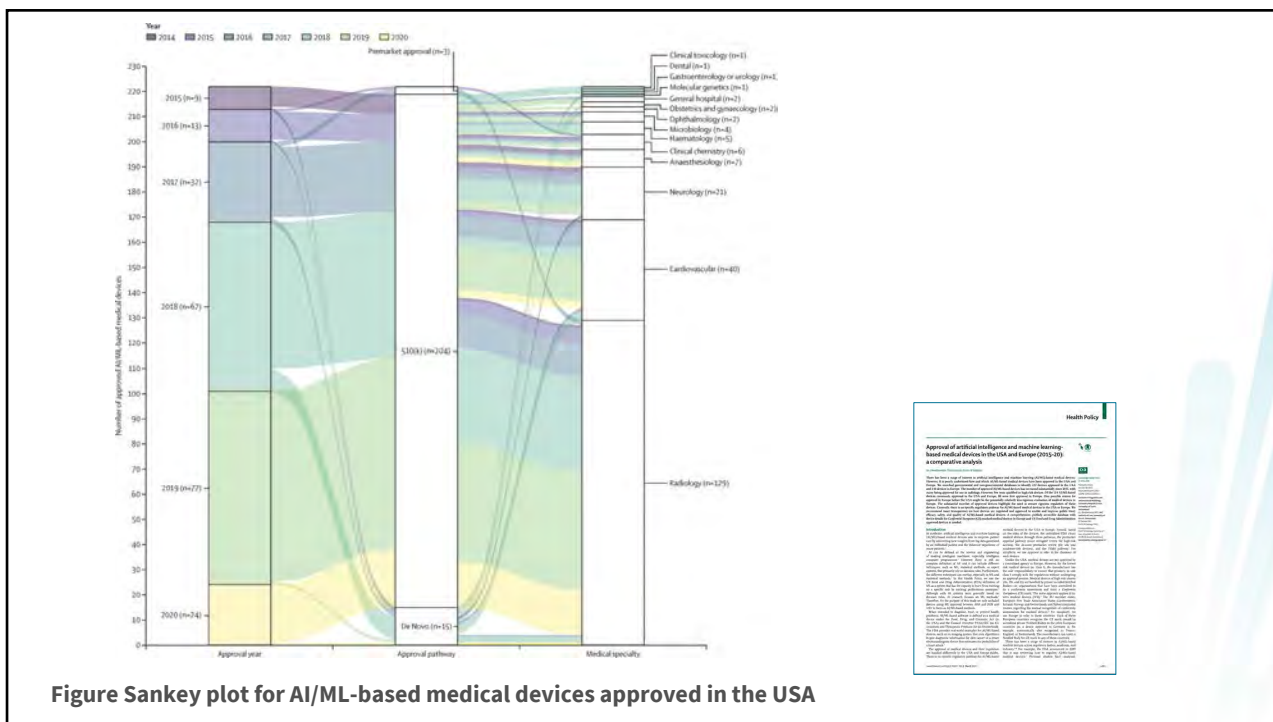
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**Increasing  
number of AI/ML-  
based medical  
devices**

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**FEATURE ARTICLE**

### Use of Diabetes-Related Applications and Digital Health Tools by People With Diabetes and Their Health Care Providers

Karin Doyle Delgado and James J. Chubbertson

The proliferation of diabetes-related patient engagement tools has led to the development of a growing number of diabetes-related digital health tools. These tools are used by people with diabetes and their health care providers to improve diabetes management. This article reviews the use of diabetes-related digital health tools by people with diabetes and their health care providers. The tools reviewed include mobile apps for diabetes management, digital health tools for diabetes management, and digital health tools for diabetes management. The tools reviewed include mobile apps for diabetes management, digital health tools for diabetes management, and digital health tools for diabetes management.

The first Apple iPhone was released in late 2007, and the Apple App Store became available 1 year later, offering 500 applications (apps). Healthcare >3 billion people use mobile apps for diabetes management, and the number of apps for diabetes management has grown significantly. The first Android smartphone was released in 2008, and the Google Play Store became available 1 year later, offering 500 applications (apps). Healthcare >3 billion people use mobile apps for diabetes management, and the number of apps for diabetes management has grown significantly.

The most widely used diabetes-related apps are those that provide glucose monitoring, insulin management, and diabetes education. These apps are used by people with diabetes and their health care providers to improve diabetes management. The most widely used diabetes-related apps are those that provide glucose monitoring, insulin management, and diabetes education.

**TABLE 1 Summary of Diabetes Apps**

App	Platform*	Type	Cost	Patient Benefits	HCP Benefits
SugarIQ	Apple	CGM	Free; Guardian CGM prescription required for use	<ul style="list-style-type: none"> <li>IBM Watson analytics for pattern detection</li> <li>Personal insights based on retrospective data provided via text messages</li> </ul>	—
BlueStar	Apple/Android	Combination blood glucose data management and lifestyle support	Free; requires access code from employer or health plan	<ul style="list-style-type: none"> <li>Artificial intelligence-derived feedback</li> <li>Custom reports and education</li> <li>Wireless data pairing</li> <li>Medication, food, sleep, exercise, and blood pressure tracking</li> </ul>	<ul style="list-style-type: none"> <li>Connected to HCP team</li> <li>Access to diabetes care and education specialists</li> <li>Electronic medical record integration</li> </ul>

Clinical Diabetes 2020 Dec; 38(5): 449-461

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**REVIEW**

### Artificial Intelligence: The Future for Diabetes Care

Samer Elshahhat, MD, PhD

*Endocrinology, Cleveland Clinic, Cleveland, Ohio; Endocrinology, Cleveland Clinic, Cleveland, Ohio*

**ABSTRACT**

Artificial intelligence (AI) is a fast-growing field with applications in diabetes, clinical practice, and research. AI has the potential to improve the diagnosis and management of diabetes. This review discusses the current state of AI in diabetes care and its potential to improve patient outcomes. AI has the potential to improve the diagnosis and management of diabetes. This review discusses the current state of AI in diabetes care and its potential to improve patient outcomes.

**INTRODUCTION**

Diabetes is a chronic metabolic condition, is a global health care burden. According to the International Diabetes Federation (IDF), 463 million people between ages 20 and 79 years have diabetes, and 774 million have impaired glucose tolerance. By the year 2045, 691 million people are likely to have diabetes. While 8.4% of the world population was reported to have diabetes in 2017, the numbers are projected to rise to 11% by 2045.

Diabetes is associated with various complications and a significant morbidity and mortality. It is important to intervene not only to treat but also to prevent and make a timely diagnosis of diabetes. Management of diabetes is challenging because 1 of 2 adults with diabetes are undiagnosed, yet 10% of global health expenditure (US\$760 billion) are spent on diabetes.

**Artificial Intelligence**

AI has been described as "a branch of computer science that aims to create systems or methods that analyze information and allow the handling of complexity in a wide range of applications." The application of AI to diabetes is feasible and desirable for efficient data handling and the development of tools and devices for its management. To provide safer technology through AI, it is recommended to have safe design, safety reserves, and procedural safeguards, with all uncertainties identified for all potential technical systems.

Technical advances have introduced wearables, smart phones, and other gadgets that care and in the continuous monitoring and tracking of patients' symptoms and disease status. Physicians and health care professionals should

### CLINICAL SIGNIFICANCE

- Artificial Intelligence (AI) will cause a paradigm shift in diabetic management through data-driven precision care.
- AI has changed the way diabetes is prevented, detected, and managed, which can help in bringing down the global prevalence of 8.8%.
- Case-based reasoning, machine learning, deep learning, and neural networks enable predictive population risk stratification, automated retinal screening, enhanced decision making, and self-management.
- AI positively impacts medical professionals by supporting decision making and remote monitoring.

Am J Med, 2020 Aug;133(8):895-900.

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# High ambitions

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**IEEE Spectrum** Tomorrow's AI Will Reason Like Humans, IBM Watson D... 🔍 Type to search

PROFILE THE INSTITUTE

## Tomorrow's AI Will Reason Like Humans, IBM Watson Developer Predicts

David Nahamoo says machines will grok us

BY JOANNA OGDORZICH | 03 SEP 2021 | 4 MIN READ | 📄


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TAGS

- IBM
- IBM WATSON
- SPEECH RECOGNITION TECHNOLOGY
- NATURAL LANGUAGE PROCESSING
- PRYON
- AI
- ARTIFICIAL INTELLIGENCE
- IEEE MEMBER NEWS

When David Nahamoo was a high school student in Iran, he wanted to pursue a career in mathematics or physics. But after talking over career options with his friends, he says, he was "pointed in the direction of a good career in Iran" and instead decided to become an electrical engineer. Today the IEEE Life Fellow is CTO of Pryon, a startup in Raleigh, N.C., that is developing a natural-language-processing AI system for businesses. The company's programs aim to make companies more productive, reducing costs and eliminating inefficiencies.



Nahamoo is an expert in speech and language technologies. He spent almost 35 years at IBM Research in Yorktown Heights, N.Y., developing innovative AI technologies such as Watson. The supercomputer won a game on Jeopardy! in 2011 against two of the U.S. TV show's most successful contestants. Watson answers questions using advanced

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# IBM Watson

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... the products that have emerged from IBM's Watson Health division are nothing like the brilliant AI doctor that was once envisioned: They're more like AI assistants that can perform certain routine tasks.

Only a few AI-based tools have been approved by regulators for use in real hospitals and doctors' offices. Those pioneering products work mostly in the visual realm, using computer vision to analyze images like X-rays and retina scans.



<https://spectrum.ieee.org/how-ibm-watson-overpromised-and-underdelivered-on-ai-health-care>

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**Project: Sugar.IQ**

Medtronic and Watson Health began working together in 2015 on an app for personalized diabetes management. The app works with data from Medtronic's continuous glucose monitor, and helps diabetes patients track how their medications, food, and lifestyle choices affect their glucose levels. The FDA-approved app launched in 2018.

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**DISCOVER HIDDEN REASONS FOR HIGHS OR LOWS.**

Do you love being active but hate how you feel afterward? The Sugar.IQ™ assistant combines advanced intelligence from IBM Watson™ and world-leading diabetes expertise from Medtronic to look at why certain activities could make you go high or low<sup>1</sup>. It gives you the most helpful information at the right moment to help uncover patterns that affect your levels — so you can confidently make small adjustments that can have a big impact on your day.

**KNOW YOUR TRENDS WITH MY DATA.**

90

DATE	IBM PARTNER	PROJECT	CURRENT STATUS
2011 Feb.	Nuance Communications	Diagnostic tool and clinical-decision support tools	No tools in use
Sept.	WellPoint (now Anthem)	Clinical-decision support tools	No tools in use
2012 March	Memorial Sloan Kettering Cancer Center	Clinical-decision support tool for cancer	Watson for Oncology
Oct.	Cleveland Clinic	Training tool for medical students; clinical-decision support tool	No tools in use
2013 Oct.	MD Anderson Cancer Center	Clinical-decision support tool for cancer	No tool in use
2014 March	New York Genome Center	Genomic-analysis tool for brain cancer	No tool in use
June	GenieMD	Consumer app for personalized medical advice	No app available
Sept.	Mayo Clinic	Clinical-trial matching tool	Watson for Clinical Trial Matching
2015 April	Johnson & Johnson	Consumer app for pre- and postoperation coaching; consumer app for managing chronic conditions	No apps available
April	Medtronic	Consumer app for personalized diabetes management	Sugar IQ app
May	Epic	Clinical-decision support tool	No tool in use
May	University of North Carolina, others	Genomic-analysis tool for cancer	Watson for Genomics
July	CVS Health	Care-management tool for chronic conditions	No tool in use
Sept.	Teva Pharmaceuticals	Drug-development tool; consumer app for managing chronic conditions	No tool in use; no app available
Sept.	Boston Children's Hospital	Clinical-decision support tool for rare pediatric diseases	No tool in use
Dec.	Nutrina	Consumer app for personalized nutrition advice during pregnancy	No app available
Dec.	Novo Nordisk	Consumer app for diabetes management	No app available
2016 Jan.	Under Armour	Consumer app for personalized athletic coaching	No app available
Feb.	American Heart Association	Consumer app for workplace health	No app available
April	American Cancer Society	Consumer app for personalized guidance during cancer treatment	No app available
June	American Diabetes Association	Consumer app for personalized diabetes management	No app available
Oct.	Quest Diagnostics	Genomic-analysis tool for cancer	Watson for Genomics from Quest Diagnostics
Nov.	Celgene Corp.	Drug-safety analysis tool	No tool in use
2017 May	MAP Health Management	Relapse-prediction tool for substance abuse	No tool in use

Diabetes

91

**Real-World Assessment of Sugar.IQ with Watson—A Cognitive Computing-Based Diabetes Management Solution**

**Results:** There were 11,356 sensor-wear days; 10,761 unique **Sugar.IQ** usage sessions collected; and 4,688 insights delivered (1 every 3 days).

The **Sugar.IQ** app was used **2.1 times/day**. Compared to baseline, **TIR was 33 minutes longer per day** (P<0.15) and **hypoglycemia events reduced by 1.0 per month** (P<0.001).

A week after receiving insights associated with hypoglycemia, 55% and 54% of users had fewer hypoglycemia and hyperglycemia events, respectively.

Hyperglycemia events >2 hours reduced by 1.3 per month (P<0.001).

**After receiving insights about low glucose associated with boluses delivered at rapid rates of change, users tended to take smaller boluses and consume less carb in the following 7 days.**

Among insights that included user feedback, 86% of users rated them as “Helpful” vs. “Not helpful.”

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Diabetes 2018 Jul; 67(Supplement 1)

92



# VI HAR GJORT OSS HELT AVHENGIGE AV TEKNOLOGI OG AT TEKNOLOGIEN FUNGERER 100% AV TIDEN

93

Nyheter Sport Kultur Distrikt Mer

Troms og Finnmark

## UNN skulle oppdatere systemet for pasientjournalene – må utsette flere operasjoner

Universitetssykehuset Nord-Norge satte mandag krisestab på alle avdelinger. På grunn av datatrøbbel er de tvunget til å utsette flere operasjoner. Men nå er systemet oppe og går igjen.



10.2.2020

– Det har vært ei oppgradering på pasientjournalssystemet. Akkurat nå har vi ikke tilgang til journalene. Da blir det vanskelig å utføre operasjoner og å ta imot pasienter til poliklinikkene, sa kommunikasjonssjef Jørn Resvoll ved Universitetssykehuset Nord-Norge (UNN) i mandag formiddag.

Klokken 13.25 bekrefter UNN at pasientjournal-systemet nå er oppe og går igjen.

– Nå fungerer oppkoblingene til pasientjournal-systemet igjen, og vi er i ferd med å komme tilbake til normal drift, sier Resvoll.

Universitetssykehuset Nord-Norge satte mandag krisestab på alle avdelinger.

På grunn av datatrøbbel er de tvunget til å utsette flere operasjoner. Men nå er systemet oppe og går igjen.

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94



**La oss se på et  
eksempel på hva  
som kommer av  
teknologi**

95

**Hjemme hos  
meg og deg ...**

96

# Video

<https://www.youtube.com/watch?v=GfjGPTKBFB4>

97

**Vi må ikke glemme de menneskelige siderne ved teknologien**

**Digitized patient-provider interaction: How does it matter? A qualitative meta-synthesis**

Høge K. Andreassen<sup>1,2</sup>, Kari Dyb<sup>3</sup>, Carl R. May<sup>4</sup>, Catherine J. Pope<sup>5</sup>, Line L. Wirth<sup>6</sup>

**ABSTRACT**

Technological innovation in the digitalization of health has predominantly been studied using qualitative approaches. Research in this field has grown steadily since the mid-1990s but to date, no synthesis has been conducted to integrate this now (often comprehensive) corpus of data. In this paper we present a meta-synthesis of 15 papers reporting qualitative studies of digitally mediated patient-provider interaction. By describing the detailed descriptions of digital practices in the most basic relationship in health care, we explore how these studies can illuminate important aspects of social relations in contemporary society. The interpretive synthesis enables us to present a sociological view that places changes in social structures and interaction in the core of questions about the digitalization of health care. Our synthesis of this literature identifies four key concepts that point to important processes of change: life course that shapes patient-provider interaction as digitalized, relations are reorganized, and there are reconfigurations of relational (re)configurations. These lead to especially specific practices, which can be characterized as reconfigurations and reorganizations of social practices which in turn are related to the reconfigurations of basic social institutions. We propose a new direction for exploring the digitalization of health care to illustrate how digital health is related to contemporary social change.

**1. Introduction**

The deployment of ICT in health – which we here refer to by the shorthand-term health – has grown steadily in recent decades and research that investigates it has also flourished. Sociological methods and theory have been pivotal in understanding the different domains in which health has developed how digital technologies have been used in health care. This work has been part of a much wider sociological engagement with the dynamic and changing of technological change, the ways that these are experienced, and their wider effects in shaping social relations and practice. For the example, Jacobs (2002), Hirschman (2003), The idea that major sociotechnical transformations are occurring, and that – in the advanced economies, at least – these involve and shape important changes in social relations, is common to several traditions of sociological thought (e.g., Latour & Woolgar, 1979; Giddens, 1984; Hughes, 1987; Ogburn & Schramm, 1988). The sociotechnical approach is thus highly relevant to health research, and has been an important point of departure also for those authors in previous works (Andreassen, 2012; Andreassen et al., 2013; May et al., 2013).

98



Vi omgis av stadig mer teknologi innen helse og omsorg, men vet lite om hvilken effekt teknologien vil ha på samfunn og familier, sier forskere bak ny studie.  
 (Illustrasjonsfoto: De Visu / Shutterstock / NTB scanpix)

## Ny helseteknologi kan gi mer jobb for familien

Digitale helsetjenester kan påvirke og endre familielivet.

Konsekvensene denne teknologien har for samfunnet må belyses bedre, mener forskere ved Nasjonalt senter for e-helseforskning.

99

**For hva skjer på hjemmebane når én i familien er syk og i økende grad klarer seg hjemme ved hjelp av teknologi, i stedet for å ta turen til en helseinstitusjon? Er det bare positivt?**

--Samfunnsforsker Hege K. Andreassen



100

# Helsesektoren følger etter utviklingen i samfunnet forøvrig



101

# Amazon følger med deg og gir deg personlige råd



102

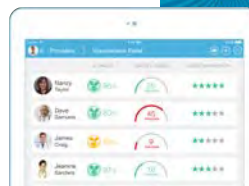


# Pasienten i sentrum (Patient empowerment)

103

## IT'S THE New Digital Medicine

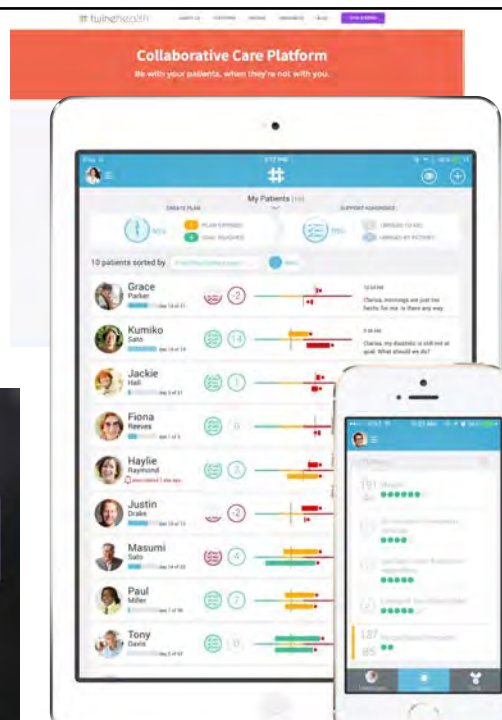
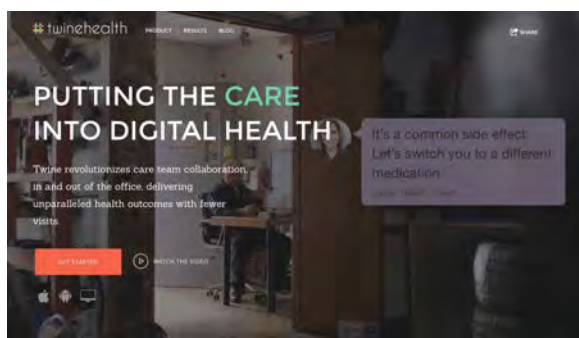
- Pasienter bruker apper og utstyrsenheter for å jobbe sammen med helsepersonell for å leve et sunnere liv og redusere hyppigheten av sykebesøk.
- Folk har personlig utstyr som holder dem sunne og frisk(ere).
- Teknologien gjør det mulig for pasienter å spore fremgangen over tid og potensielt "ta tak i" helseproblemer før de blir for alvorlige.



104

## New Digital Medicine

Eksempel: **Twine Health** fokuserer på å forbedre digitale forbindelser mellom pasienter og helsepersonell.



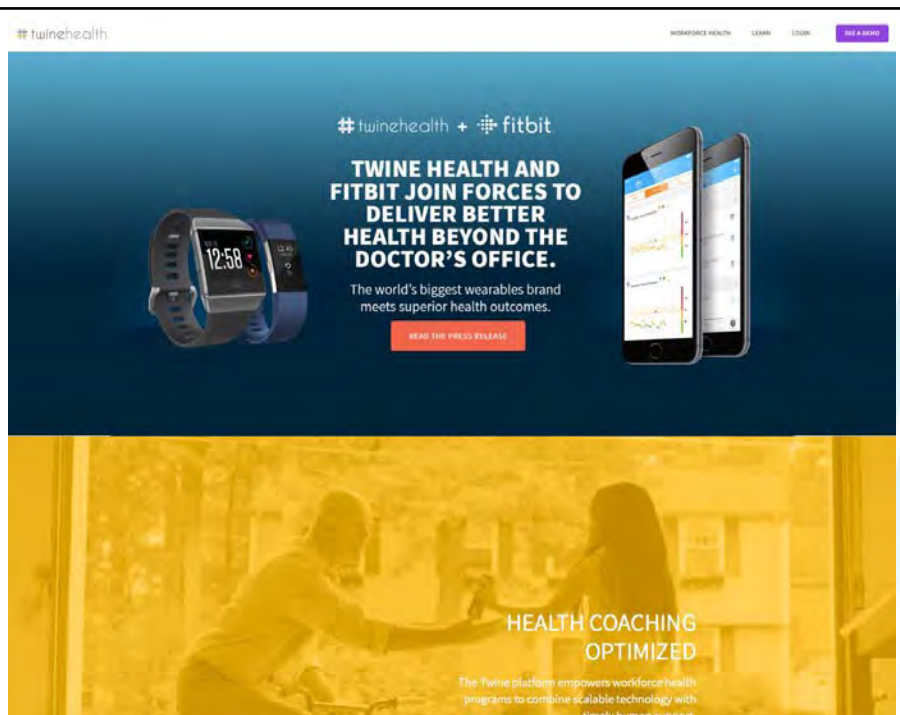
105

## Video

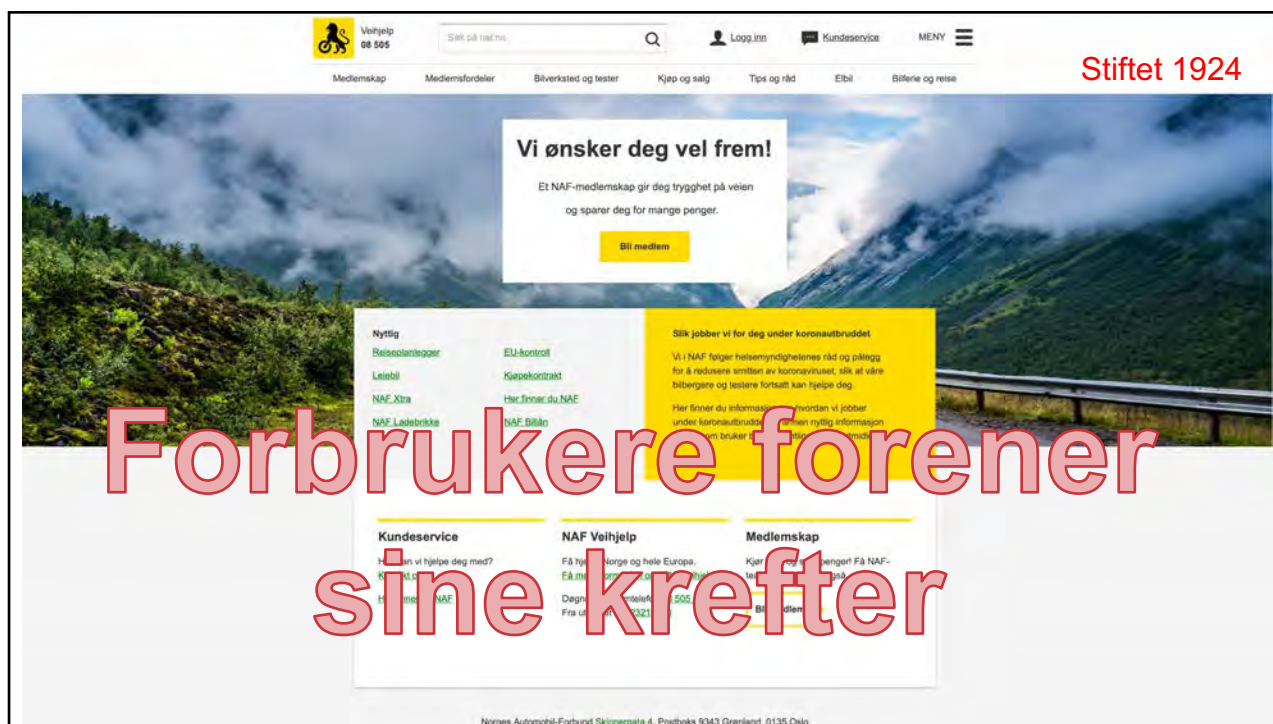
<https://www.youtube.com/watch?v=gpmoGRm0csY>

106

**Twine Health ble kjøpt opp av Fitbit som igjen ble kjøpt opp av Google**



107



108

# Pasienter søker sammen og forener krefter

109

The screenshot shows the homepage of patientslikeme.com. At the top left is the logo 'patientslikeme'. To the right are two buttons: 'Join now! (it's free)' and 'Already a member? Sign in'. Below the logo is a navigation menu with 'Patients', 'Conditions', 'Treatments', 'Symptoms', and 'Research'. The main content area features three primary sections: 1) A large image of a man holding a sign that says '#MoreThan' with a large right-pointing arrow. Text next to it reads 'DigitalMe™ The next step to personalized health' with a 'Learn More' button. 2) A blue box titled 'The future of health' with a graphic of two figures and binary code, and a 'Watch Video' button. 3) A portrait of a woman with a quote: 'Without our voices, things would remain status quo.' and a 'Learn More' button. At the bottom, a section titled 'Member and Partner Benefits' includes three icons: 'Live better together' (two people), 'Partner with us' (microscope), and 'Data for Good' (hand holding a heart).

110



## Video

<https://www.youtube.com/watch?v=xGnfWjUXf4g&t=4s>

111

**Huslegen har  
gjenoppstått**

112

# Video

<https://www.youtube.com/watch?v=xqSb-l7U2Ro&t=1s>

113

The screenshot shows the Best Buy website interface for the TytoCare - TytoHome Medical Exam Kit - White. The top navigation bar includes the Best Buy logo, a search bar, and links for Top Deals, Deal of the Day, Credit Cards, For Your Business, Gift Cards, and Gift Ideas. Below the navigation bar, there are links for Products, Brands, Deals, and Services, along with Account, Shopping History, Order Status, and Saved Items. The main content area features the product title, model number (G 15 BKU: 6332714), a 4.7-star rating from 139 reviews, and 5 answered questions. A large image of the medical exam kit is displayed, along with smaller images of its components. To the right, the price is listed as \$299.99, with a financing option of \$50.00/mo. A yellow 'Add to Cart' button is prominent. Below the product image, there are several video thumbnails: 'TytoCare Customer Testimonials' (4:53), 'TytoCare - Product Overview' (3:40), 'See How TytoCare Works' (2:24), and 'VinePhone' (1:44). A 'Cardmember Offers' section is also visible, mentioning 8 Month Financing and rewards.

114

# NASA control center

115

# **NASA-inspirert sykehusdrift**

Johns Hopkins Hospital, Baltimore, USA

116

## Video

<https://www.youtube.com/watch?v=PY4vw4LRw2U>

117



The screenshot shows the DNB website interface. At the top, there is a navigation bar with the DNB logo and various menu items. The main content area features a large banner image of a Norwegian fjord and a cliffside. The text on the banner reads: "Norgesferien din har aldri vært viktigere. Nå kan du vinne Norgesferie til 10 000 kroner – hver uke." Below this, there is a button that says "Prøv lykken, bli med i trekningen!". A circular badge on the right side of the banner indicates "10.000,-". Below the banner, there are several smaller promotional tiles, including one for "Supertilbud" (Super Offer) and another for "Ny båt til sommeren?" (New boat for summer?).

# Bankklokaler uten kunder

118



# Et sykehus uten pasienter


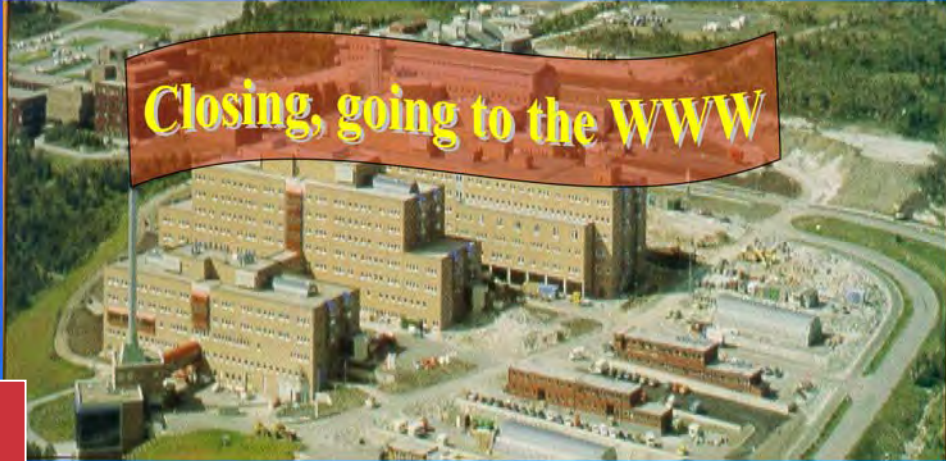
Mercy Health Virtual Care Center

119


Video

<https://www.youtube.com/watch?v=jAQuEZUdB-A&t=5s>

120



Steinar Pedersen avsluttet ofte sine foredrag for 25 år siden med dette bildet



Nasjonalt senter for telemedisin  
Regionssykehuset i Tromsø

121

Teknologi er med  
oss over alt

122

Norge Siste nytt Dokumentar Klima NRK Ytring

## Smartklokken reddet Toralv

Natt til lørdag falt Toralv Østvang (67) hardt i badegulvet alene på Hamar. En knapp halvtime senere fant politiet ham blodig og bevisstløs. De hadde fått beskjed av smartklokken rundt håndleddet hans.



REDDET AV KLOKKEN: Politiet i Hamar fant en blodig og forslått Toralv Østvang natt til lørdag etter at klokken hans ringte dem.  
FOTO: PRIVAT

Natt til lørdag falt Toralv Østvang (67) hardt i badegulvet alene på Hamar. En knapp halvtime senere fant politiet ham blodig og bevisstløs. De hadde fått beskjed av smartklokken rundt håndleddet hans.

123

HRS Sør-Norge @HRSSorNorge

SAR helikopter Sola rykket ut til Kvinesdal ifm aktivering av SOS/mayday funksjon på smart klokke. Falsk alarm denne gang. Anmoder at personer som besitter personlig nødsender setter seg inn i bruken av denne for å unngå unødvendig bruk av redningsressurser.

08:29 - 18. mar. 2018

17 retweets 18 liker

HRS Sør-Norge @HRSSorNorge · 11.1  
Seilbåten med 2pob slopes til land av RS K.G. Jølsen. Hadde motorhåvil og derfor ingen lanterner.  
Vis denne tweeten

HRS Sør-Norge @HRSSorNorge · 11.1  
2055: Observasjon av seilbåt som driver ved Nordnes, Bergen. Båten er mørklagt og er til fare for skipstrafikk. HRS sender ut redningskøyte for sjekk.  
Vis denne tweeten

Er du ikke på Twitter??  
Registrer deg

Du vil kanskje også like  
redningsselskapet @NSSR  
HRS Nord-Norge @HRSNordNorge

124

# Digital Twin

125

Video

<https://www.youtube.com/watch?v=H6JzPCbyVSM&t=1s>

126



Nett i alt, over alt,  
for alle

127

**Helsetjenester  
tilgjengelig for  
ABSOLUTT alle**

Babylon Health

128

## Video

<https://www.youtube.com/watch?v=CMD6B8h6Pzg>

<https://www.youtube.com/watch?v=Y8NkwQLo-6o>

129

**Roboter har  
erstattet  
mennesker**

130

# **Robotene kommer, i alle fall robotassistert helsehjelp**

131

Video

<https://www.youtube.com/watch?v=2Hw7eGmnpeE>

132

The screenshot shows the Wikipedia article for "Lindbergh operation". The page title is "Lindbergh operation" and it is from Wikipedia, the free encyclopedia. The article text is highlighted in a light blue box. The text describes a tele-surgical operation performed on September 7, 2001, by Professor Jacques Marescaux and his team from the IRCAD (Institute for Research into Cancer of the Digestive System). The operation was carried out by a team of French surgeons located in New York on a patient in Strasbourg, France, using telecommunications solutions based on high-speed services and sophisticated Zeus surgical robot. This was the first time in medical history that a technical solution proved capable of reducing the time delay inherent to long distance transmissions sufficiently to make this type of procedure possible. The link between the robotic system and the surgeon was provided by a high-speed fiberoptic service deployed thanks to the combined efforts of several France Telecom group entities. Commenting on the operation, Professor Marescaux said:

133

## Video

<https://www.youtube.com/watch?v=d7lojFFHtiA>

134



# Spørsmål?

[gunnar.hartvigsen@uit.no](mailto:gunnar.hartvigsen@uit.no)