USE CASE How UMC Utrecht offers smart healthcare through the use of integrated diagnostics and machine learning



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How UMC Utrecht offers smart healthcare through the use of integrated diagnostics and machine learning

Hermen Jan van Ree, Director Digital Health



Intelligent Health, 13-09-2023



- 12.000 employees
- **235.433 patients**
- 4.000 students

UMC Utrecht & Utrecht University high(est) in

international rankings

Princess Máxima Center

RIVM

Utrecht University

Central Military Hospital

Hubrecht Institute

GenMab

Wilhelmina Children's Hospital

HU Utrecht

UMC Utrecht

Together we strive to improve people's health and create the healthcare of tomorrow



UTRECHT SCIENCE PARK

Healthcare Outlook

Staff shortages

The shortage of healthcare workers is expected to rise to as many as 135,000 workers by 2030.

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Growing demand

Aging leads to growing demand for care and an increase in multi-morbidity. In 2040, an increase of 25% is expected in people with two or more chronic conditions.

Rising workload

Almost 44% of healthcare workers experience a high to very high workload. This workload continues to increase.

Our Response

We are redesigning the processes for care, research and education based three principles







Digital Health



Description

with online measurements, facilitating diagnostic research and of lab research

with periodic (self) measurements via digital questionnaires and telephone support

with 24/7 monitoring of vital functions with medical wearables and acute chain support

with 24/7 monitoring of vital functions with medical wearables and acute chain support

with data science and AI applications using clinical or operation data and openly available models

with people-oriented support to monitor and treat patients in their own living environment

Examples



ophthalmology teletriage team (dermatology, physiotherapy, orthopedics, audiology, etc.)



@Home apps for low-complexity and high-complexity chronic patient groups



COVERED as well as Early@Home and Therapy@Home for acute patient groups



oxygen at home, intravenous antibiotics, immunoglobulins, chemotherapy

Speech-to-EMR, Glasgow Coma Scale, No-Show-Prediction, Discharge Letters, OR Planning



40+ monitoring students, nurses, supervisors and CNIO as well as MGB and BZU





Sleep Well Baby - an automated real-time sleep-wake state prediction algorithm in preterm infants

Live by Richard Bartels, Jeroen Dudink & Team



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Sleep Well Baby

- Preterm infants sleep up to 22 hours a day
- Sleep contributes to brain development

"Sleep is one of the most powerful tools to protect the vulnerable, newborn brain."

Dr. Jeroen Dudink, Pediatrician-Neonatologist and Sleep Researcher at UMCU-WKZ



Sleep Well Baby

- Lack of sleep at Neonatal IC Units
- Increased risk of health complications
- Sleep/wake state hard to recognise

- An automated sleep-wake state prediction algorithm in preterm infants
- based on real-time heart rate, oxygen saturation and respiration rate
- showing the likely sleep status of the child on a bedside monitoring monitor
- Babies get maximum undisrupted sleep leading to improved mental and physical development
- Specialists can schedule medical and caring procedures around an infant's natural sleep cycle
- Researchers gain insights into preterm sleeping patterns and the impact thereof on development





Positively impacting 15 million preterm infants annually





Glasgow Coma Scale - automating and digitalising the GCS by cleverly combining open-source models

PoC by Sjoerd de Vries, Dara Niknejad & Team



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Glasgow Coma Scale

- Glasgow Coma Scale used to assess patient's level of consciousness
- Nurse assesses responses, calculates score and indicates state





Glasgow Coma Scale

- Laborious & time consuming task
- Scarcity of specialised ICU nurses
- Subjectivity leading to variability

Cleverly combining openly available models

- Eye open/closed detection OpenCV
- Body Pose estimation Openpose
- Pose-to-Score algorithm UMC Utrecht
- Speech-to-Text Whisper
- Text interpretation GPT 3.5

- Nurse saves 5 minutes per patient per hour
- Neurologist gets more consistent GCS score
- Patient receives (more) suitable treatment
- Hospital frees up time for other health care
- More thorough monitoring outside of ICU's
- Scope to be extended (e.g. pupillary size)





Automating the Glasgow Coma Scale

A proof of concept



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Positively impacting millions of patients and nurses daily





No-Show-Prediction - a predictive algorithm predicting the probability of no-shows at outpatient departments

Minimum Viable Product by Ruben Peters et al.



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No-Show-Prediction

No Shows UMC Utrecht	
No shows without cancellation	18.242
No shows with cancellation <24h	19.609
No-show telephone appointments	12.311
Total no shows UMC Utrecht	50.162

"If you can't make your appointment, someone else can."



No-Show-Prediction

- Wasted resources
- Lost revenue
- Delayed care
- Increased waiting times
- Overbooking and double-booking
- Administrative costs

- A predictive algorithm predicting the probability of no-shows
- using patient, appointment, behaviour and time variables
- supported by Medical Service Centre calling team
- Calling the 35% of patients with the highest chance of no-show 3 days before their appointment to result in 15% less no-shows
- Leading to 7.500 additional shows for UMC Utrecht





Positively impacting healthcare systems around the globe





Speech-to-EMR - automated recording and summarising of interaction between care provider and patient

Working Prototype by Laura Veerhoek et al.



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Speech-to-EMR

 Administration in healthcare is multifaceted and crucial for the effective functioning of healthcare systems and the delivery of quality patient care

"You don't become a nurse to fill in scores and type over information."



Speech-to-EMR

- Time-consuming and costly
- Burden on healthcare staff
- Complexity prone to errors
- Inefficiencies in the system

- A speech-to-text model (Whisper by OpenAI) that processes a conversation in real time and converts it to written text
- A Large Language model (GPT-3.5 Turbo) that interprets the text and returns the answers to several predefined questions

- Generating admission & discharge docs
- Automating registration & declaration
- Processing paper surveys to EMRs

- Summarising patient records
- Generating referral letters









Positively impacting each patient and care provider in the world



AI Implementation in Healthcare







More Information

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Our human-centered digital health services: <u>Slimme zorg - UMC Utrecht</u> Our Medical Services Centre: <u>Meer eigen regie over zorg - UMC Utrecht</u> Podcast: <u>In het medisch regiecentrum van het UMC Utrecht - Zorgvisie</u>

