

Automated Prediction of post-COVID RecOvery Of Functioning to support rehabilitation interventions: the A-PROOF study

Problem:

COVID-19 is a disease caused by the novel 'severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)' with often unknown and possibly major consequences on all domains of functioning. Fourteen percent of COVID-19 patients may require hospitalization and oxygen support, and five percent require admission to an intensive care unit (ICU). Both the disease and its treatment may result in long lasting and severe loss of functioning, but our understanding of the impact and long term outcome is still largely unknown. In current rehabilitation of post COVID-19 patients, strategies are designed based on initial rough guesses, which can only be adjusted afterwards. A fast and accurate insight into the course and predictors of functioning of post-COVID-19 patients is of great importance for the early deployment of appropriate and personalized rehabilitation. This requires the use of new research techniques based on artificial intelligence (AI), which make it possible to predict the impact of COVID-19 on the functioning of patients and to identify determinants relevant for rehabilitation decisions.

Aim:

To recognize, predict and assess the (determinants of) recovery of functioning of COVID-19 patients by using AI techniques. Rich and diverse information, available in Electronic Patient Records encompassing written notes by health care professionals, is automatically harvested using automated text mining techniques. The level of functioning, its progression over time and relevant factors influencing this functioning will be analysed and described using categories of the International Classification of Functioning, Disability and Health (ICF, WHO 2001) relevant for patients.

Research question:

How do COVID-19 patients recover their functioning during and after hospitalization, based on automatically analyzed text data from Electronic Patient Records? Which factors determine the course of recovery? How can automated recognition and prediction of recovery be used to support decision making regarding rehabilitation of COVID-19 patients?

Sub-questions:

- 1) Which ICF categories are most relevant from a COVID-19 patient's perspective, taking into account gender, age and cultural differences?
- 2) What is the functional level of patients with COVID-19 as automatically assessed by text-mining techniques, using existing Big Data and Deep Learning?
- 3) How does recovery of functioning of COVID-19 patients evolve over time?
- 4) Which rehabilitation-relevant factors predict the course of recovery of functioning of COVID-19 patients?
- 5) How can automatic prediction of recovery of functioning support decision making for patients, professionals and policy makers?

Projectteam:

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Short bibliography

Piek Vossen is full professor in Computational Lexicology at the Faculty of Humanities in the Vrije Universiteit Amsterdam. He is a leading scholar in language understanding, developed so-called reading machines in the European NewsReader project and recently develops models for communicative robots participating in the NWO gravity project Hybrid Intelligence. He supervised more than 10 PhDs since 2009, published over 300 peer-reviewed publications in international conferences, journals, books and edited volumes. In 2013, he received the prestigious Spinoza-prize for his groundbreaking research on wordnets and NewsReader. He also received the Enlighten-Your-Research prize in 2013 for NewsReader's challenge to process daily news-streams of millions of articles. Through the Spinoza prize, his group comprises 20 researchers that work on the semantic processing of text and understanding of language by machines. (see: <http://vossen.info/>)

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Short bibliography

Carel Meskers is a specialist in neurorehabilitation and associate professor at the Department of Rehabilitation Medicine of VU University Medical Centre (VUmc), Amsterdam. Dr. Meskers' primary focus is ageing of the of the neuromuscular system encompassing sarcopenia post stroke motor recovery and its underlying pathophysiological mechanisms, i.e. neuromechanics and innovative assessment and training paradigms like smart sensors, haptic robotics, instrumented treadmills, EEG/EMG assessment. Dr. Meskers is medical director of the Dutch Innovative Medical Devices Initiative (IMDI) Center of Excellence "Neurocontrol" and PI or Co-PI of various large multidisciplinary and multicenter research projects. Dr. Meskers has been appointed visiting Professor at Northwestern University, Chicago, USA in 2015 and Associate Professor at VU Medical Center in 2016. Dr. Meskers has (co) published over 150 papers in peer-reviewed journals and has a Hirsch index of 33 (Scopus).

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Short bibliography

Guy Widdershoven is professor of Medical Philosophy and Ethics and head of the Department of Medical Humanities at VU University Medical Center, Amsterdam. He is senior researcher in the Amsterdam Public Health Research Institute. He is former scientific director of the School for Public Health and Primary Care (Caphri) of Maastricht University, and the Dutch National Research School for Primary Care Research (CaRe). He was president of the European Association of Centers for Medical Ethics (EACME). Currently he coordinates two Horizon 2020 projects on Research Integrity: Mapping the Research Integrity Framework (EnTIRE) and Virtue based ethics and Integrity of Research: Train-the-Trainer program for Upholding principles and practices of the European Code of Conduct for Research Integrity (VIRT2UE). The partners in these projects have initiated a platform for Research Integrity: The Embassy of Good Science. He is author of over 200 articles and chapters in books on hermeneutic ethics, empirical ethics and moral case deliberation. He supervised over 40 PhD dissertations.

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Short bibliography

Marike van der Leeden is involved in research concerning rehabilitation in patients with musculoskeletal disorders (osteoarthritis, rheumatoid arthritis, and chronic widespread pain), and patients with cancer (with a focus on peri-operative care). She has been appointed as senior researcher at the Department of Rehabilitation Medicine, Amsterdam UMC (location VUmc and Reade | Rehabilitation and Rheumatology, Amsterdam).

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Short bibliography

Edwin Geleijn is a health care innovation manager in the field of rehabilitation.

He has been involved in numerous projects amongst others:

- Development of exercise oncology programs
- Development of a nationwide physiotherapist network for the implementation of oncology exercise programs
- Development of transmural trauma rehabilitation programs
- Development of peri-operative care programs, both in hands-on physiotherapy and with the aid of activity monitoring and a smartphone app
- Development of a fall prevention program for elderly admitted to an emergency department due to a fall
- Development of a textmining based prediction model for the detection of fall incidents of inpatient patients derived from text notes in the electronic patient records

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Short bibliography

Sabina van der Veen works as a researcher at the Department of Medical Humanities, Amsterdam UMC (location VUm) and as a coordinator on Active and Healthy Ageing at the Amsterdam Economic Board. Since 2010, she has been working on the research and implementation of the ICF in the healthcare sector. She also worked for The Committee on Innovation Health Care Professions & Education on behalf of the Ministry of Health, well-being and sports and the Ministry of Education.