

# E-Health & Telemedizin



Prof. Dr. med. Dr. phil. Thomas Hügle  
Rheumatologie  
CHUV, Lausanne

- Background digital transformation
- Telemedicine
- Apps
- E-health, AI and work capacity



# The Digital Revolution

- Computational power (from PC to quantum computing)
  - Telecommunication, Internet (of things)
  - Smart phones, applications
  - Cameras, new generation sensors
    - 8-12 sensors in a phone: camera, accelerometer, gyroscope, magnetometer, GPS, light sensor, microphone, touch screen, finger print...
  - Artificial intelligence
    - Mimicking “cognitive” functions of a human mind  
recognition, assistance, automatization, learning, prediction, problem solving
    - Data are key, ideally + sensors + available simulator
  - Robots
    - E.g. industry, daily life, care
-



# The history of E-health

- Health and disease online platforms (information, exchange, patient forums) on PCs
- Search engines, symptom tracker
- Big data, cohorts, electronical medical records, patient reported outcome
- Teleconsultation & Telemonitoring
- **Applications & mobile health**
- Sensors, wearables ect.
- Virtual reality
- **Artificial intelligence**



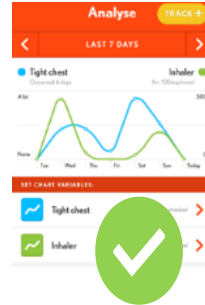
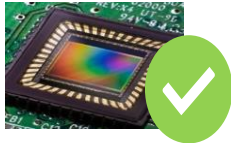
Powered by  
German Health Act 2019 &  
COVID19

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Digital biomarker

Disease specific

Motion tracker



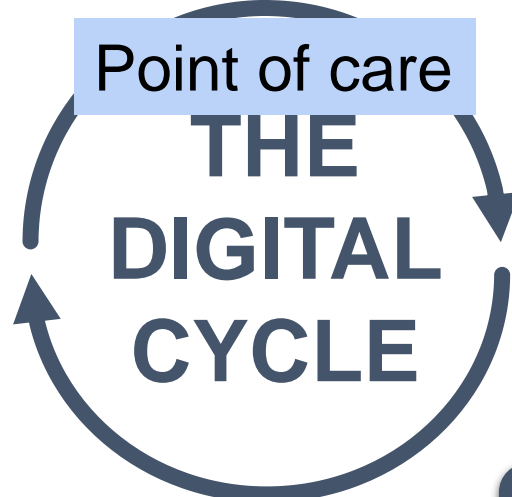
Disease monitoring, ePRO's, T2T  
Medication management

**Management & Digital therapies)**



Behavioural intervention  
e.g. weight, nutrition, depression, compliance

**User interfaces**



**Artificial intelligence**

= Learning systems

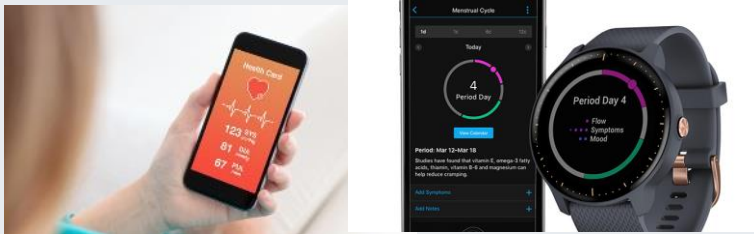


Disease forecast  
+Hyperpersonalisation

AI-assisted care

1

## Data interfaces



PROs, self-management applications, wearables, sensors, PACS, EPA

2

## Data management platform

Interfaces, interoperability, structured data, data location? – cloud, in-house, server collect, organise, store, share data safety, privacy, compliance?

3

## Artificial intelligence

Analyse, learn, assist

- Understanding complex patterns
- Prediction, clustering
- Decision making support
- Saves time and money
- Improves safety





# Regulation



## Digital health regulation:

- „Software as a device“
- Server in Switzerland
- GDPR compliance (how personal data are collected and processed)
- MDR (Medical device regulation): Medical devices must comply with the applicable legal requirements and undergo a certification process in order to verify their conformity
- Quality management
- CE-Certifikate

<i>Risk class</i>	<i>Class I (low risk)</i>	<i>Class IIa (low to medium risk)</i>	<i>Class IIb (medium to high risk)</i>	<i>Class III (high risk)</i>
<i>Examples</i>	<i>Adhesive plasters, corrective glasses</i>	<i>Contact lenses, dental fillings, tracheal tubes</i>	<i>X-ray devices, urethral stents</i>	<i>Cardiovascular catheters, hip, shoulder and knee joint prostheses, pacemakers</i>



# Are telemedicine and digitization becoming the new normal?

**Forbes** Billionaires Innovation Leadership Money Business Small Business Lifestyle

2020 2,349 views | Apr 21, 2020, 11:05pm EDT

## How COVID-19 Will Accelerate A Digital Therapeutics Revolution

 **Columbia Business School - the Eugene Lang Entrepreneurship Center** Contributor   
Leadership Strategy  
*We cover topics in entrepreneurship, corporate innovation, and venture capital.*

 *Guest Post by Tom Guthrie*

 The COVID-19 pandemic has created global upheaval as individuals, healthcare systems, and governments struggle to respond to the crisis. In the

 midst of it all, digital healthcare startups have taken on the important roles of caring for patients impacted by the virus and maintaining a functioning healthcare system as it shifts towards remote care.



*The newly adopted Digital Healthcare Act :*

- Full digital transformation of the healthcare system;
- Telemedicine becoming the new normal;
- Doctors prescribing Apps as a Treatment, reimbursed by health insurances





## Acceptance of Telerheumatology by Rheumatologists and General Practitioners in Germany: Nationwide Cross-sectional Survey Study

Felix Muehlensiepen, MPH, Dr rer medic, Johannes Knitza, MHBA, Dr med, [...], and Martin Welcker, Dr med

[Additional article information](#)

### Abstract

### Background

The worldwide burden of musculoskeletal diseases is increasing. The number of newly registered rheumatologists has stagnated. Primary care, which takes up a key role in early detection of rheumatic disease, is

**Conclusion:** Before COVID-19 appeared... low use but high acceptance of the implementation of telerheumatology among physicians.

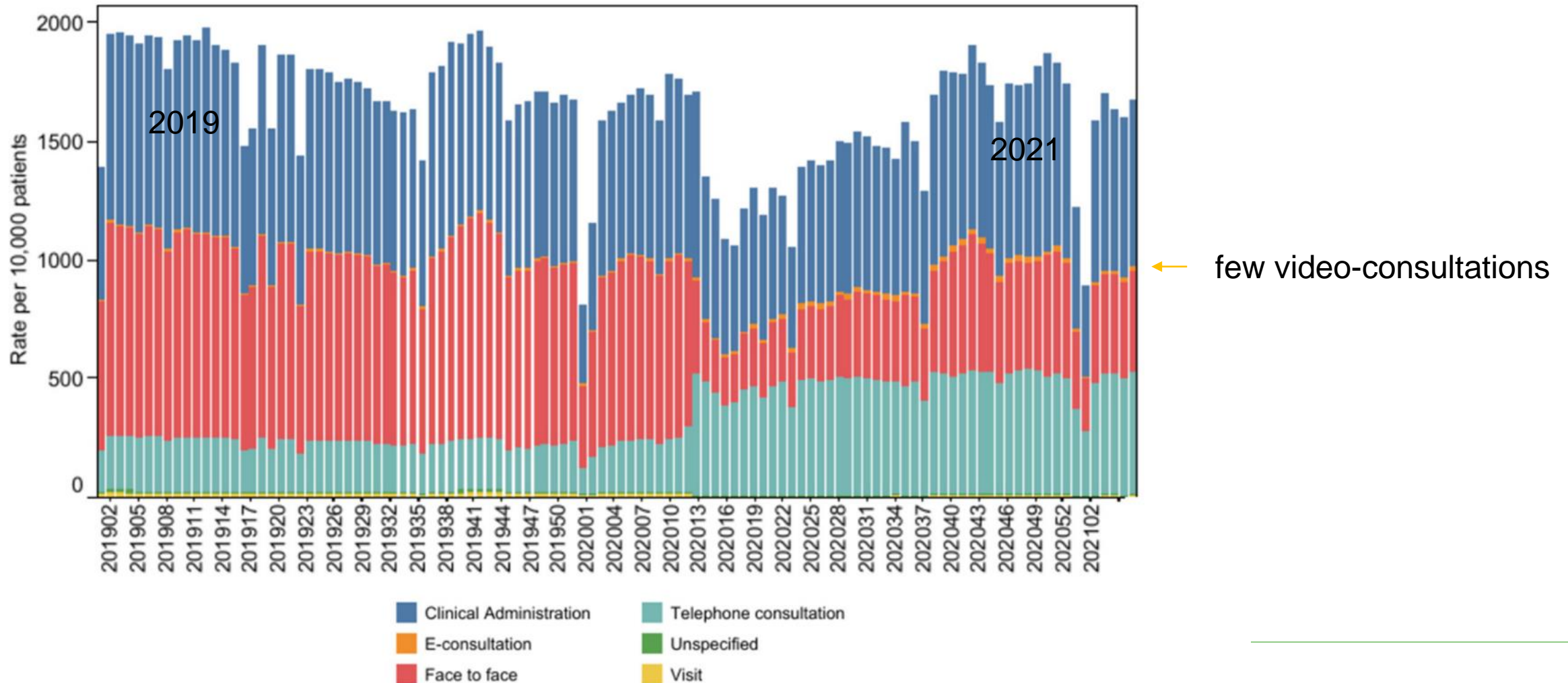
Training courses should be introduced to address the limited knowledge on the part of physicians in the use of telemedicine...

The goal of this study was to investigate acceptance and preferences related to the use of telerheumatology care among German rheumatologists and general practitioners.

# SM Telemedicine in England

## Primary Care Informatics Response to Covid-19 Pandemic: Adaptation, Progress, and Lessons from Four Countries with High ICT Development

Siaw-Teng Liaw<sup>1</sup>, Craig Kuziemy<sup>2</sup>, Richard Schreiber<sup>3</sup>, Jitendra Jonnagaddala<sup>1</sup>, Harshana



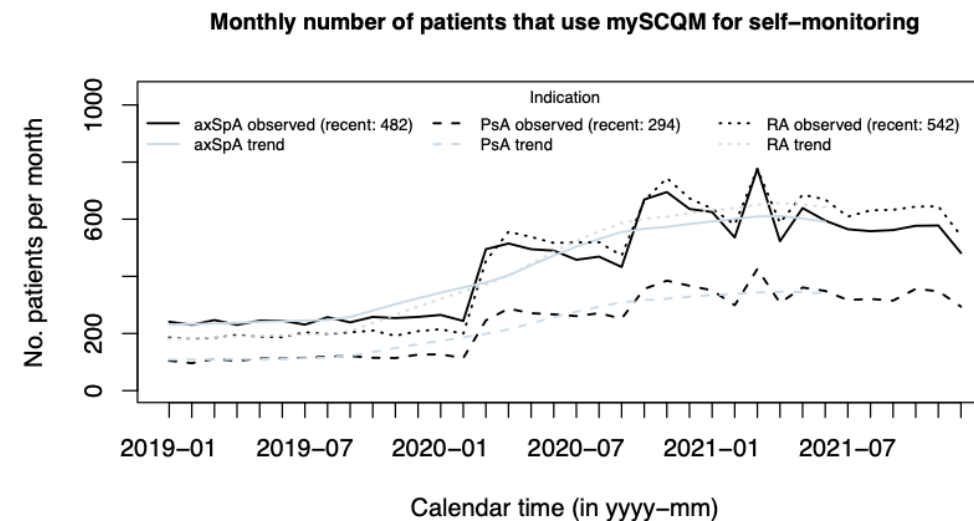


# Telemedicine: own experiences during the pandemic

- Video consultation shorter, less remunerated
- Secretariat has to create link ect. (Zoom, Webex ect., sometimes poor transmission quality)
- Poorer medical quality (no ultrasound, clinical examination...)
- Peak 1st wave, since 3rd wave almost disappeared at our hospital
- More emails, Outlook unsuitable...
- CHUV@home
- But: Strong increase of the MySCQM App (Patient reported outcome)



# SCQM App in Switzerland: a success story boosted by the pandemic



# Arthritis-App: Advantages for patients

- ✦ Patient is actively involved in the treatment (patient empowerment)
- ✦ Clear overview of the long-term course of the disease (patient journey) and medication (scoreboard)
- ✦ Possibility to set treatment goals with the doctor and evaluate them together on the basis of data (shared decision making, treat-to-target)

# Arthritis-App: Advantages for doctors

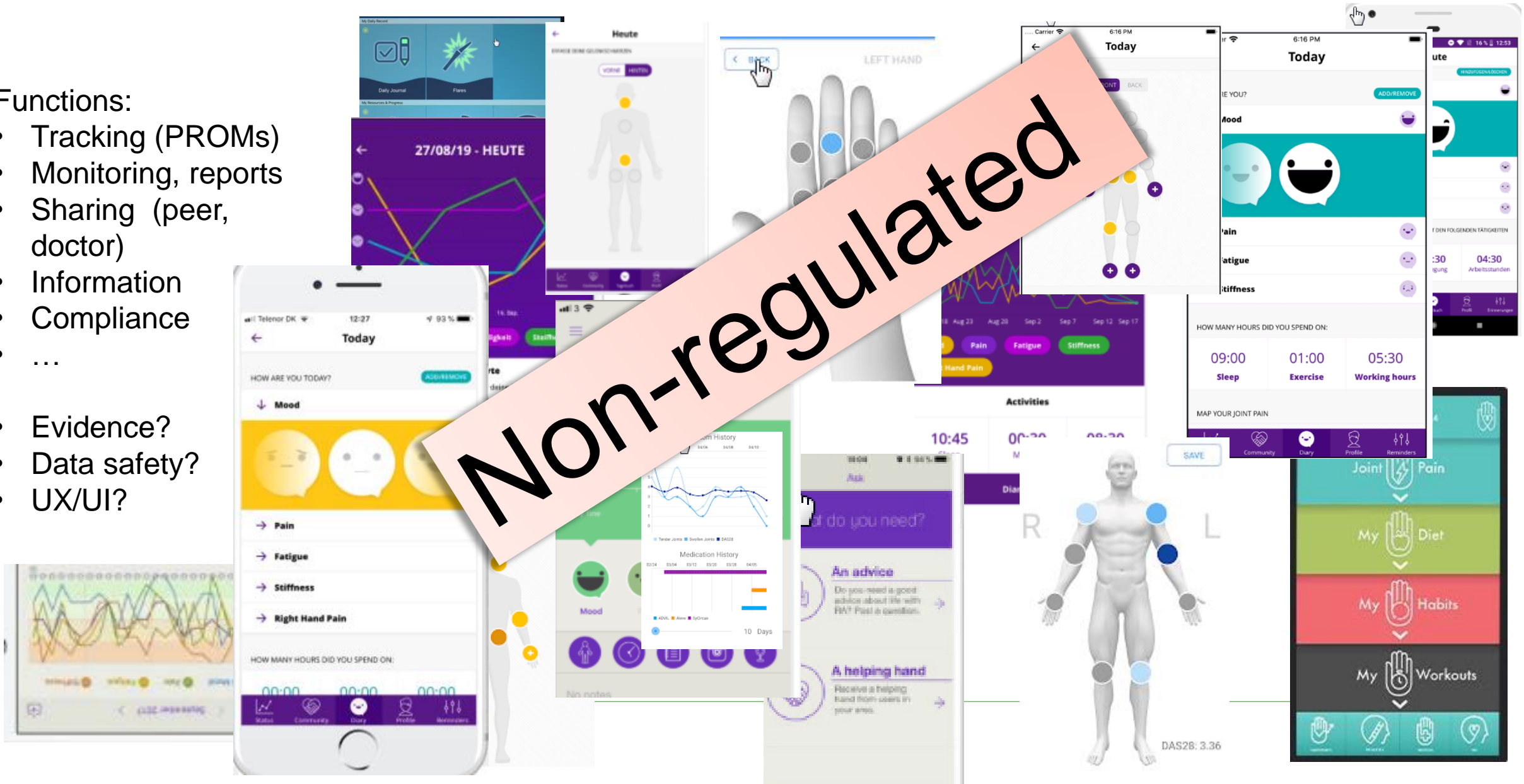
- ✦ Better overview through disease-adapted dashboard (compared to clinic or practice software).
  - ✦ Better patient monitoring / disease surveillance
  - ✦ Better treat-to-target = better treatment quality
  - ✦ Feedback and report of the current visit can be easily sent to the general practitioner without much administrative effort
-



# Self-management Apps for Arthritis in the App store

## Functions:

- Tracking (PROMs)
- Monitoring, reports
- Sharing (peer, doctor)
- Information
- Compliance
- ...
- Evidence?
- Data safety?
- UX/UI?



# S/M 2019: Digitales Versorgungsgesetz





INNOVATION

**Health apps become an export hit**

# Gesundheits-Apps werden zum Exportschlager

Deutschland hat die App auf Rezept, die von der Kasse erstattet wird, vor über einem Jahr eingeführt. Andere Länder wollen die Innovation nun adaptieren.



Lukas Hoffmann



Britta Rybicki

## Medical benefit



Patient relevant effect  
Related to:

Improvement of  
Health condition,  
duration of illness,  
survival,  
Quality of life

and/  
or

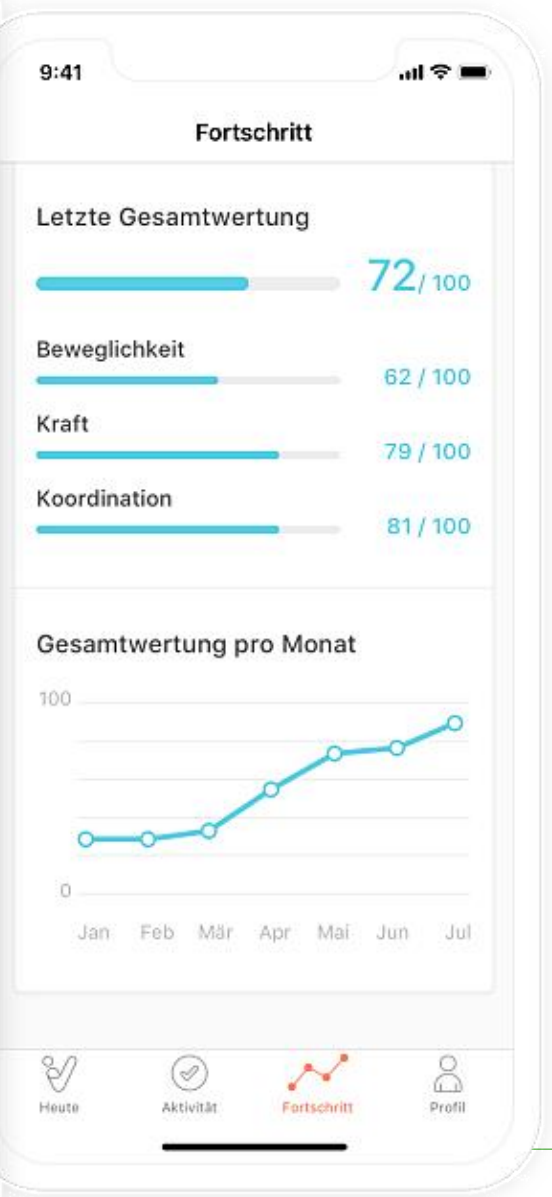
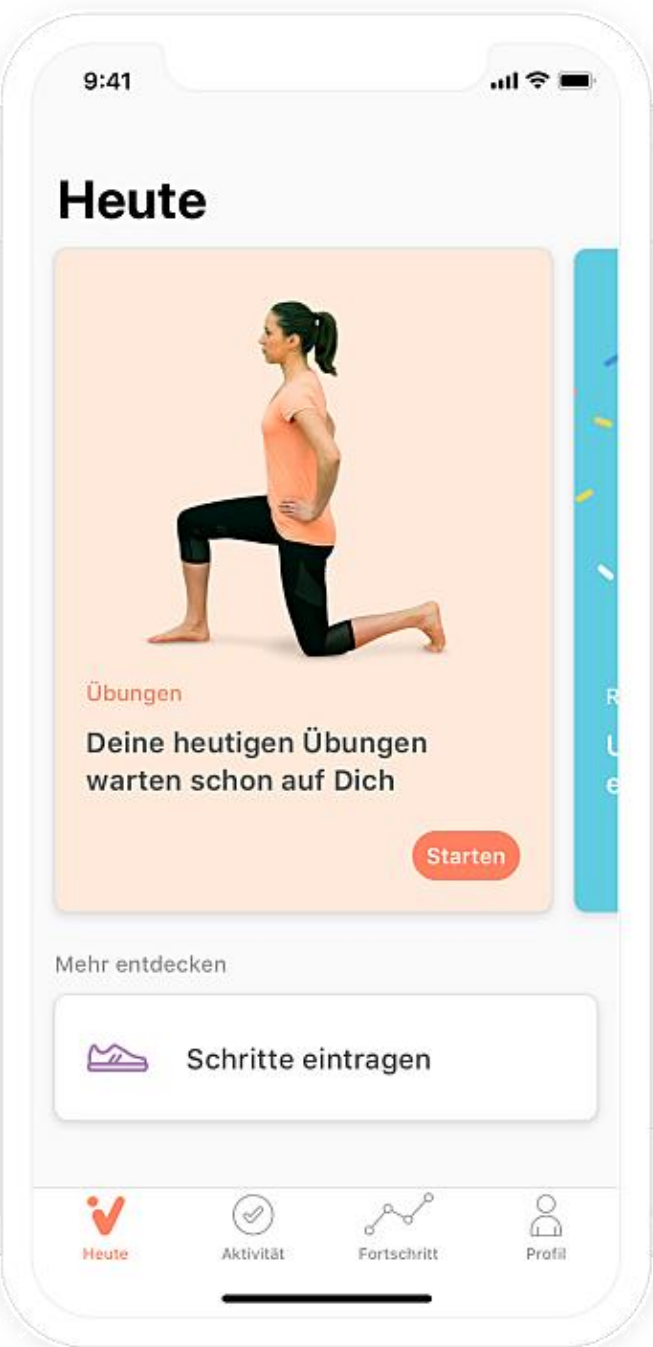
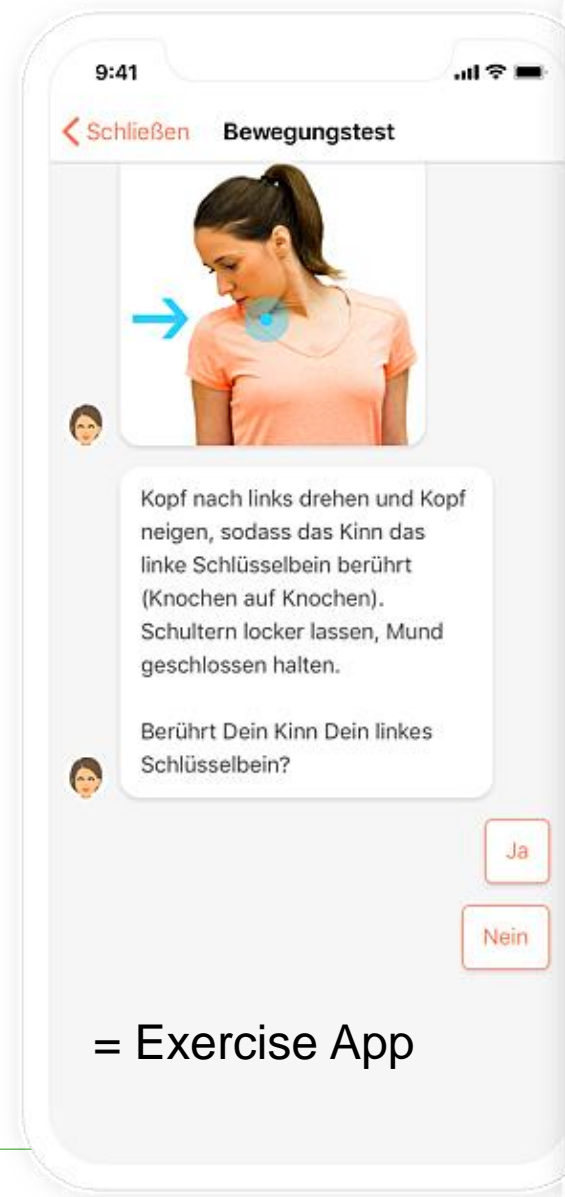
## Patient-relevant structure and process improvements

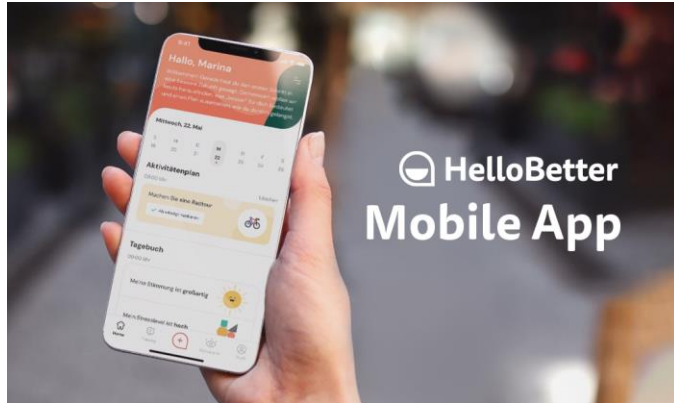


Treatment recommendations  
Adherence,  
Standards,  
Patient safety,  
health literacy,  
disease management,  
...

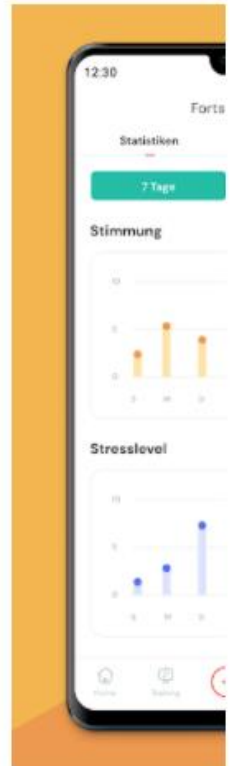
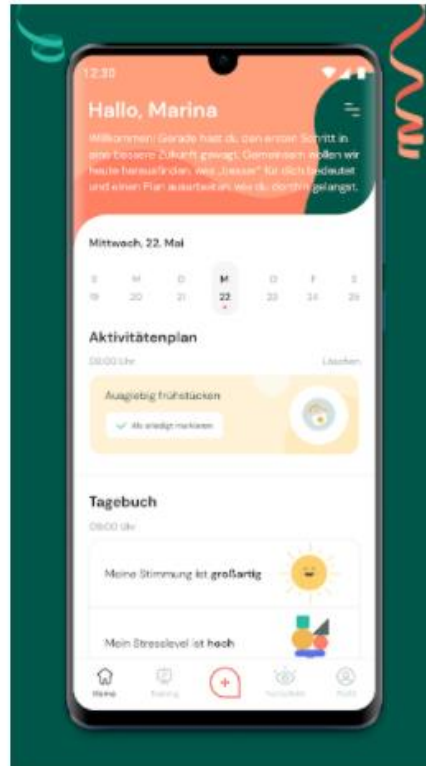
und Belastungen der Patienten und ihrer Angehörigen

+ CE-certified medical product / Quality management





HelloBetter  
Mobile App



PROs, cognitive behavioral thappy, mindfulness

# S/M Evidence for other Apps

ABSTRACT NUMBER: 0122

## Clinical Impact of a Digital Behavioral Therapy for Fibromyalgia Management: A Randomized Controlled Trial

Stephanie Catella<sup>1</sup>, Michael Gendreau<sup>2</sup>, Nicolette Vega<sup>1</sup>, Allison Kraus<sup>1</sup>, Michael Rosenbluth<sup>1</sup>, Sherry Soefje<sup>3</sup>, Shishuka Malhotra<sup>4</sup> and Lesley Arnold<sup>5</sup>, <sup>1</sup>Swing Therapeutics, San Francisco, CA, <sup>2</sup>Gendreau Consulting, LLC, Poway, CA, <sup>3</sup>Excell Research, Oceanside, CA, <sup>4</sup>Neuro-Behavioral Clinical Research, North Canton, OH, <sup>5</sup>University of Cincinnati, Cincinnati, OH

Meeting: ACR Convergence 2021

Keywords: fibromyalgia, health behaviors, physical function, quality of life, Randomized Trial

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Digital Intervention: 41 daily sessions of structured ACT lessons, mindfulness practices, and activities to encourage paced exercise and behavior change  
67 patients, 12 week program  
50% improvement (>20% FIQR) vs. 25% in the control group.

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## An mHealth App for Fibromyalgia-like Post-COVID-19 Syndrome: Protocol for the Analysis of User Experience and Clinical Data

Marc Blanchard, BA, MA, Lars Backhaus, [...], and Thomas Hügler, MD, PhD, Prof Dr

[Additional article information](#)

### Abstract

### Background

Post-COVID-19 syndrome, also referred as “long covid,” describes persisting symptoms after SARS-CoV-2 infection, including myalgia, fatigue, respiratory, or neurological symptoms. Objective symptoms are often lacking, thus resembling a fibromyalgia-like syndrome. Digital therapeutics have shown efficiency in similar chronic disorders such as fibromyalgia, offering specific disease monitoring and interventions such as cognitive behavioral therapy or physical and respiratory exercise guidance.

### Objective

This protocol aims to study the requirements and features of a new mobile health (mHealth) app among patients with fibromyalgia-like post-COVID-



POST-COVID SYNDROME

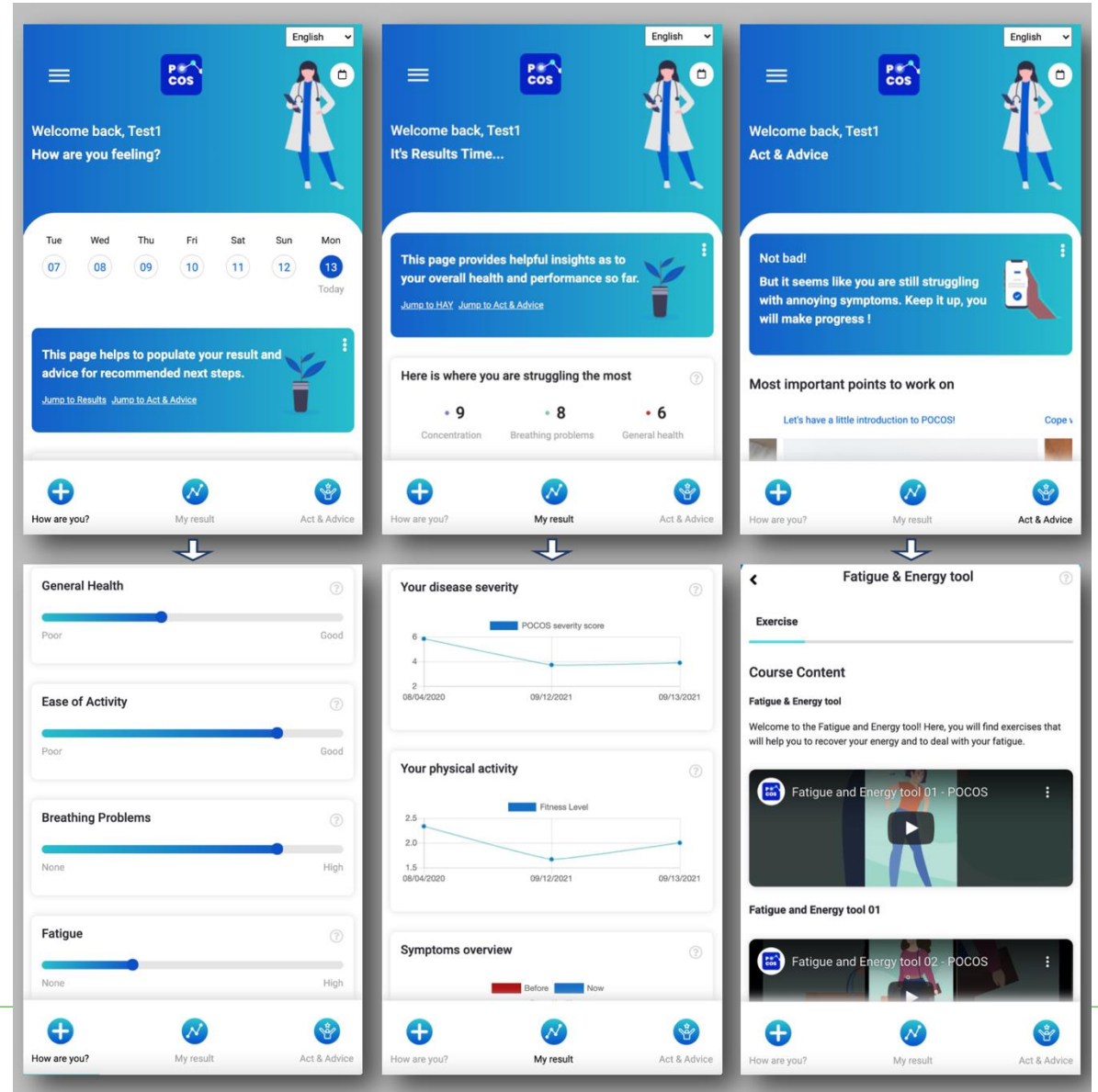
Application d'autogestion et de réhabilitation du syndrome post-COVID

## Mieux comprendre et gérer vos souffrances post-COVID

POCOS est une application de réhabilitation et d'autogestion pour les personnes qui souffrent du syndrome post-COVID. En associant les connaissances médicales croissantes de ce syndrome à une intelligence artificielle en interaction avec d'autres patients et professionnels de la santé, POCOS vous permet de surveiller et d'améliorer les symptômes de cette maladie ainsi que sa réhabilitation.



[www.postcovid.cloud](http://www.postcovid.cloud)





# E-health & Assurance medicine





## Exemple

- FABQ Physique: 18, FABQ Travail: 36
- POAM persistant: 6, POAM modulant: 32, POAM évitant: 40
- Le score moyen de douleur du BPI est de 8,75/10
- Score d'interférence de 9,29/10 (Tan G et al, J Pain 2014).
- Score de kinésiophobie est de 54/68 (cliniquement significatif si >40;)
- Le score d'anxiété de 17/21
- Score de dépression de 13/21 (0-7: normal; 8-10: modéré; 11-14: moyen;15-21: sévère)
- Le score de catastrophisme est de 49/52 (cliniquement significatif si >30)



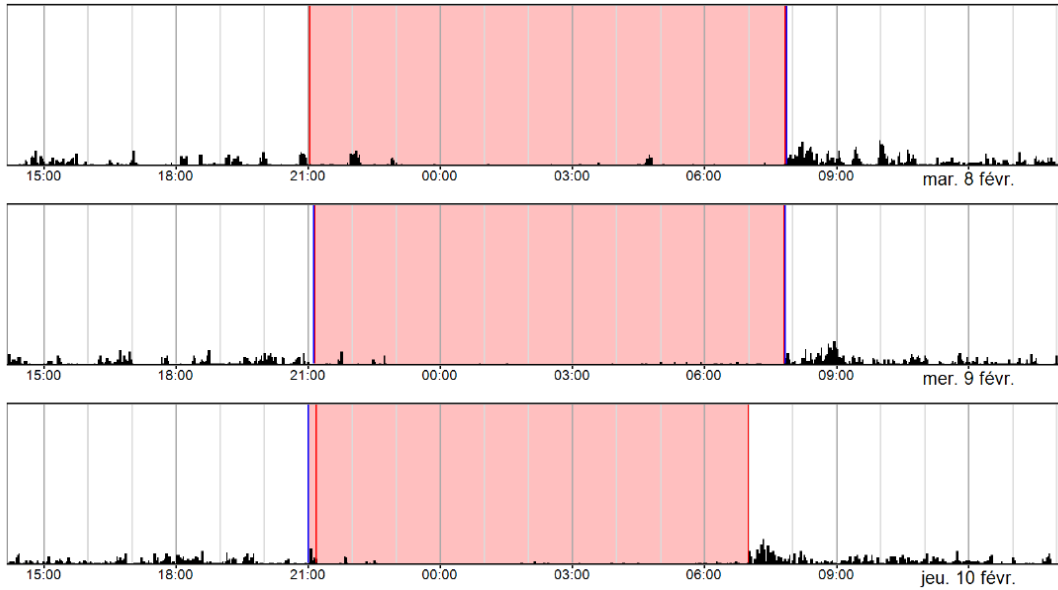
= Quantitative assessment



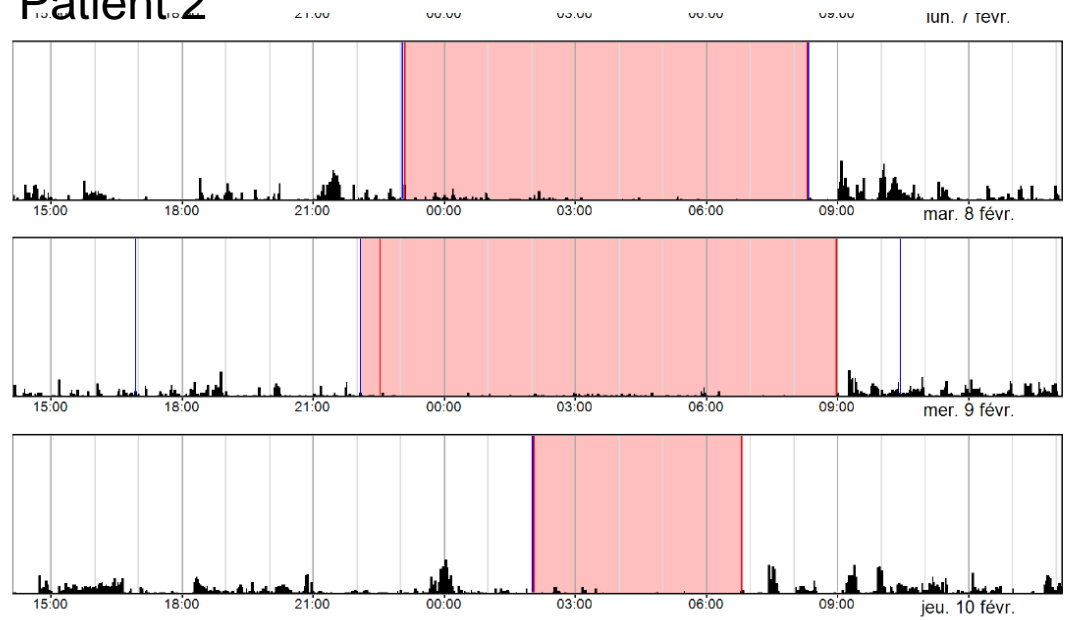
# Sleep assessment



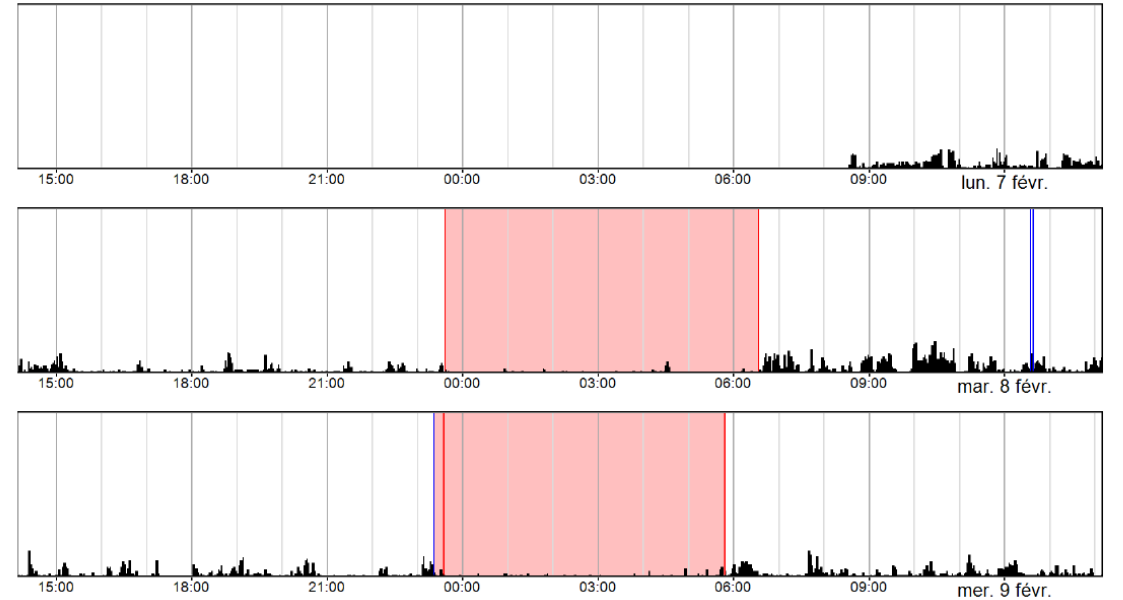
## Patient 1



## Patient 2



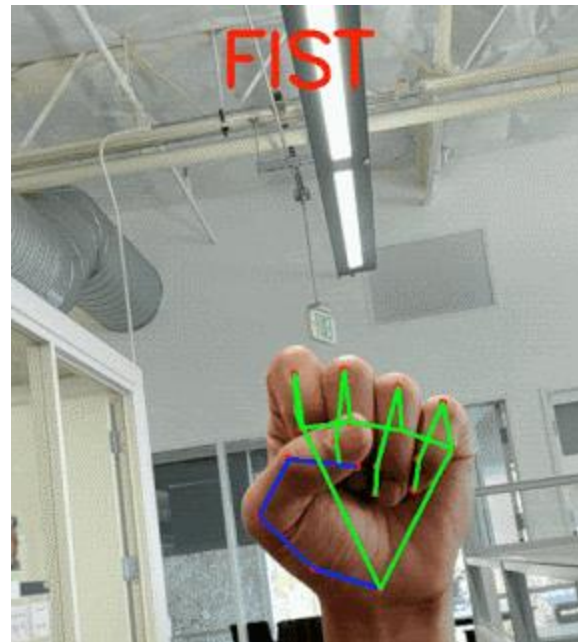
## Patient 3





# Sleep assessment

<b>Start day</b>	Min	Average	Max	<b>Wake bouts</b>	18	23.0	27
<b>Day of week</b>	-	-	-	<b>Mean sleep bout</b>	00:11:15	00:15:22	00:19:35
<b>End day</b>	-	-	-	<b>Mean wake bout</b>	00:01:52	00:02:06	00:02:14
<b>Lights out</b>	23:08	23:35	23:59	<b>Immobile mins</b>	287.0	342.0	378.0
<b>Fell asleep</b>	23:10	23:37	23:59	<b>Immobile time (%)</b>	88.3	90.1	92.0
<b>Woke up</b>	05:23	05:57	06:35	<b>Mobile mins</b>	33.0	37.4	44.0
<b>Got up</b>	05:24	05:58	06:35	<b>Mobile time (%)</b>	8.0	9.9	11.7
<b>Time in bed</b>	05:25	06:23	06:57	<b>Immobile bouts</b>	21	27.2	31
<b>Assumed sleep</b>	05:24	06:19	06:57	<b>Mean immobile bout</b>	00:09:34	00:12:51	00:16:00
<b>Actual sleep time</b>	04:30	05:31	06:08	<b>Immobile bouts &lt;=1min</b>	2	2.8	4
<b>Actual sleep (%)</b>	83.3	87.1	90.0	<b>Immobile bouts &lt;=1min (%)</b>	6.5	10.4	14.3
<b>Actual wake time</b>	00:37	00:48	00:59	<b>Total activity score</b>	2196	3457	4656
<b>Actual wake (%)</b>	10.0	12.9	16.7	<b>Mean activity /epoch</b>	5.94	9.14	12.42
<b>Sleep efficiency (%)</b>	81.7	86.3	89.5	<b>Mean nonzero activity /epoch</b>	64.59	91.70	105.82
<b>Sleep latency</b>	00:00	00:02	00:12	<b>Fragmentation Index</b>	18.2	20.3	23.6
<b>Sleep bouts</b>	17	22.2	27	<b>Threshold</b>	-	-	-
				<b>Rest per 24h (%)</b>	37.3	43.8	46.5
				<b>Central Phase Measure (min)</b>	155.5	167.5	186.5



# SIM Qualitative Research?



Medical expertise

Ressources

Coherence

Surmountability

Comorbidity

Medication

## Expertises from the past



The image shows three screenshots of medical guidelines from the AHV/AVS, dated 4.15.2011, 4.15.2012, and 4.15.2013. The 2013 version is titled "Polydisziplinäre medizinische Gutachten".

**4.15 Stand am 1. Januar 2013**

**Polydisziplinäre medizinische Gutachten**

**Allgemeines**

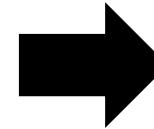
1 Die IV-Stelle muss für die Feststellung des Leistungsanspruchs der versicherten Person, die ein IV-Gesuch eingereicht hat, alle wesentlichen Tatsachen abklären. Sie beschafft sich zu diesem Zweck unter anderem alle nötigen Informationen über den Gesundheitszustand der betreffenden Person, insbesondere die Arztberichte der behandelnden Ärzte. Falls nötig, kann sie monodisziplinäre, bidisziplinäre oder polydisziplinäre medizinische Gutachten erstellen lassen. Weitere Informationen dazu enthält das Merkblatt 4.06 Das IV-Verfahren.

**Zweck des Gutachtens**

2 Die IV-Stelle kann bei einer medizinischen Gutachterstelle ein polydisziplinäres Gutachten anfordern. Ein polydisziplinäres Gutachten liegt vor, wenn es mindestens drei medizinische Fachrichtungen einbezieht, darunter die Allgemeine oder die Innere Medizin. Ein medizinisches Gutachten muss die zur Beurteilung des Leistungsanspruchs notwendigen medizinischen Angaben erbringen, insbesondere die gesundheitlichen Beeinträchtigungen und deren Auswirkungen auf die Arbeitsfähigkeit in der bisherigen beruflichen Tätigkeit oder in anderen geeigneten beruflichen Tätigkeiten.

Input features:  
 Profession  
 Diagnostics  
 Radiology  
 Clinical Exam  
 ...

Algorithm



Prediction work capacity

Output feature  
 Work capacity

Natural language processing (NLP)

# SIM Discussion

- Legal basis Health apps in Switzerland?
- Data security?
- Data Privacy?
- Certification?
- Efficiency? Security?
- Companion App vs. Digital therapy



# Thank you



Thomas.Hugle@chuv.ch

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