# CONFERENEC REPORT OF THE

# 3rd DIGITAL RHEUMATOLOGY DAY May 6th 2021

SUMMARY

The 3rd Digital Rheumatology Day was a hybrid conference on May 6, 2021 at the University Hospital Lausanne that successfully connected clinicians, researchers, and technologists from all over the world in the field of digital rheumatology. The goal of the conference was to share information and collaborate to improve healthcare access and delivery for rheumatologic patients. Over the past year, the current global pandemic not only presented many challenges in healthcare, but also accelerated advances particularly in the fields of telemedicine, AI, and digital health apps. The 3rd Digital Rheumatology Day highlighted the current evidence from digital experts and displayed the exciting future directions of research in these areas. Dr. Hans concluded the conference with the following advice: "Do not give up!" Research in digital rheumatology is challenging work, but the innovation seen throughout the 3rd Digital Rheumatology Day inspires promising future endeavors to improve quality of care for our patients with rheumatologic diseases.

# PROGRAM

## Session I: Artificial Intelligence

*Chairs: Thomas Hügle and Didier Hans*

09:00 – 09:25 Rheumatology – AI Workshop: Automated image recognition for beginners, Mateo Caorsi & Leo Caratsch
09:25 – 09:50 Flare Prediction in RA Based on Machine Learning, David Simon
09:50 – 10:15 Virtual Round Table: Relevance and practical implementation of AI solutions in rheumatology

*Coffee Break*

## Session II: Telemedicine & Wearables

*Chairs: Jacob M. van Laar and Jutta Richter*

10:25 – 10:50 Remote care in Rheumatology: upcoming EULAR guidelines, Philipp Bosch
10:50 – 11:15 Telerheumatology and Mobile Health Usage: Opportunities and Barriers, Felix Mühlensiepen
11:15 – 11:40 Asynchronous mHealth Interventions in Rheumatoid Arthritis: Systematic Scoping Review, Bart Seppen
11:40 – 11:55 Virtual Round Table : Telemedicine & wearables

*Lunch Break*

## Session III: Rheumatology Apps

*Chairs: Johannes Knitza and Martin Krusche*

12:40 – 13:05 How to DiGA in Germany, Julia Hagen
13:05 – 13:30 A smarphone-based health care chatbot to promote self-management of chronic pain (SELMA): pilot randomized controlled trial, Sandra Hauser-Ulrich
13:30 – 13:55 Mobile App-based documentation of patient-reported outcomes – three months results from a proof-of concept study on modern rheumatology patient manage, Jutta Richter
13:55 – 14:20 Outcomes of a Mobile App to Monitor Patient Reported Outcomes in Rheumatoid Arthritis: A Randomized Controlled Trial, Yvonne Lee
14:20 – 14:45 Sidekick Health: A lifestyle change application for rheumatoid and psoriasis arthritis, Saemundur Oddsson

*Coffee Break*

## Session IV: Social Media

*Chairs: Isabelle Hase and Latika Gupta*

14:55 – 15:20 Social Media use of and for people with rheumatic and musculoskeletal disease – perceptions of benefits and pitfalls, Paul Studenic
15:20 – 15:45 Social media and infographics for scholarly communication, Latika Gupta
15:45 – 16:10 Therapeutic online short-videos on Youtube for rheumatic patients, Martin Krusche

## Session V: Abstract Session

*Chairs: Didier Hans and Thomas Hügle*

16:10 – 16:25 Decision support system for diagnosing Rheumatic-Musculoskeletal disease using fuzzy cognitive MAP technique, Ade Akinnuwesi & Blessing Adegbite
16:25 – 16:40 Monitoring patients with rheumatic conditions remotely using data from smartphones, Fransisco Nunes
16:40 – 16:55 The SCQM Coronavirus study – using remote care and digital instruments to facilitate and accelerate data collection and patient communication, Almut Scherer

*Coffee Break*

## Session VI: Pitching event for new digital solutions

17:05 – 17:50 Presentations of the 3min elevator pitch videos submitted by providers and developers of digital care solutions that (could) improve quality of care in rheumatology
Fishbowl discussion
Johannes Knitza, Felix Mühlensiepen, Matthias Diener and Thomas Hügle

## INTRODUCTION

The 3rd Digital Rheumatology Day was a hybrid conference held on May 6, 2021 at the Swiss Convention Center in Lausanne, Switzerland. This annual meeting connects leading experts from a wide variety of disciplines, including physicians (Rheumatologists, Radiologists, Rehabilitation, Internal Medicine, Immunologists), patient support communities, pharma and MedTech industries, Health IT companies, medical associations and the administrative sector.

The meeting featured 6 sessions consisting of 13 lectures, 2 roundtable discussions, abstract presentations, and a pitching session. The overarching themes consisted of artificial intelligence AI) etc. The event hosted by the Digital Rheumatology Network was well received by 148 participants from 15 countries.

## EMERGING TOPICS DISCUSSED AT THE CONFERENCE

### Artificial Intelligence

The Artificial Intelligence (AI) session kicked off with a live workshop led by Matteo Caorsi and Leo Caratsch of the University Hospital Lausanne to help us understand AI in rheumatology. Caorsi and Caratsch performed a live demonstration in the AI software Giotto to show attendees how they can run machine learning (ML) algorithms on their own data. The goal of the workshop was to develop a model capable of recognizing signs of hand osteoarthritis (OA) by providing Kellgren-Lawrence scores in order to automate the detection and classification of hand OA. Using data from a previous study of the Swiss Clinical Quality Management Foundation (SCQM) registry containing 7500 bilateral hand radiographs,[1] the presenters conducted a pilot project of ML to identify OA in the DIP joints of 369 hands. Their AI pipeline consisted of manual labeling to teach the computer the regions of interest, augmentation to enlarge and bias the dataset, and segmentation to teach computer how to classify each pixel, and finally the AI model. Results revealed high segmentation (84% Dice) and classification scores (85% accuracy), indicating validation between the two methods (human scoring versus machine learning). This proof of concept shows promise with human comparable accuracy, and is first step toward deployment in practice. There are still some limitations that must be worked out regarding sharing of the data, particularly in regards to its ethical and legal ramifications.

Next, Dr. David Simon, a rheumatologist working on ML from the University of Erlangen-Nuremberg, Germany, presented his team's work on flare prediction using ML in individuals with RA tapering biological disease-modifying anti-rheumatic drugs.[2] Using data from the longitudinal RETRO clinical trials in Germany,[3,4] Dr. Simon and his team studied 41 patients with RA. The previous RETRO studies used the inference approach (flare incidence at group level and focus on intervention with statistical models), whereas Dr. Simon used a prediction approach (flare probability on the individual level focusing on predictors and using ML models). Results showed that the ML algorithm demonstrated fair performance in flare prediction at the individual level, with a change in medication being the most important feature of the model.

During the roundtable discussion following these presentations, a common question that emerged was regarding the practical application of these methods. Dr. Simon envisions using these methods as a tool in clinical practice to better guide clinical decisions in order to prevent the trial/error practice that so many providers currently use. It is important to think of AI as a tool to support, not replace, clinical decisions. Prof. Hans suggested AI be referred to as "augmented intelligence" to better represent the concept of complimenting human decisions.

Validation is another shared concern among AI researchers that was discussed during the roundtable. Similar to epidemiology research, the dataset used for AI research should be as representative as possible to the target population. Otherwise the dataset will have to be a model adapted and optimized to the target population via ML. Currently, the best methods for this are to take algorithms that you would be interested in using and test them on your own clinical data to validate the model. These best practices are necessary because there are so few regulations or guidelines for AI in rheumatology at this time. There still remain several limitations to work out regarding the ethical and legal ramifications of AI in medicine.

## Telemedicine and Wearables

In regards to new initiatives in telemedicine, Dr. Philipp Bosch of the Medical University of Graz introduced a thorough systematic review currently being conducted by the European League Against Rheumatism (EULAR) with the goal to update the recommendations for telemedicine (remote care). During the height of the pandemic in 2020, EULAR created a taskforce to respond to the negative effects of the pandemic on rheumatologic care in EULAR countries.[5] The taskforce

sought to identify the best available evidence for development, prioritization, and implementation of telemedicine for patients with rheumatic diseases. Although the recommendations could not yet be shared at the time of the 3rd Digital Rheumatology Day, Dr. Bosch did share early results of the systematic review. Forty-seven studies were included and revealed that telemedicine was either favorable or not different compared to in-person standard of care.

Dr. Felix Mühlensiepen of Brandenburg Medical School, who has conducted mixed methods-research on digital health user preferences, presented data on physician and patient perspectives on telemedicine in rheumatology care.[6] He showed that 48% of patients would like their rheumatologist to provide them with recommendations for digital health options. The qualitative research has revealed concerns regarding timing of mobile health and concerns that "digitization creates a wealth gap." The data also showed that there was an agreement between patients and rheumatologists that the initial diagnosis should be made in-person, not via telemedicine.[7] These are all important considerations when implementing digital health in clinical practice or research.

Dr. Bart Seppen from the Amsterdam Rheumatology and Immunology Center presented a systemic scoping review on asynchronous mHealth interventions from clinical trials in patients with RA.[8] (Asynchronous interventions are interventions that don't involve direct patient-provider interaction.) Ten studies were included in the systematic review with four different types of interventions (SMS reminders, step counters, smartphone apps, and Web apps). All mHealth interventions worked via support to the patient or monitoring of the patient. Results of this systematic review revealed that asynchronous mHealth interventions improved medication compliance, physical activity, achievement of remission, patient-physician interaction, and self-efficacy.

A common topic of discussion for the session of telemedicine was implementation, especially in light of the recent global pandemic where telemedicine rapidly became a crucial aspect of healthcare. In order to improve uptake and access to telemedicine, we must understand the drivers and barriers to implementation of telemedicine in clinical practice. Drivers identified throughout this session included: accessibility, time saving ability, previous experience, and flexibility. Barriers that were identified in this session included: problems with insurance, lack of knowledge/confidence, digital health literacy, lack of digital safety, and inability to perform in-person clinical exams. Several opportunities for improvements were discussed, such as reaching

underserved populations and remote areas, future research endeavors, and the ability to involve patients in design of telemedicine initiatives.

## Rheumatology Apps

This session provided an overview of exciting and innovative updates to rheumatology apps. The session was initiated with Julia Hagen representing the Health Innovation Hub in Berlin, Germany. Germany is paving the way in the field of digital health applications, referred to as DiGAs. Until 2020, there was no pathway for integrating digital solutions into standard clinical care in Germany, therefore, patients didn't have access to them. Now, Germany is the first country in which apps can be prescribed and reimbursed. At the time of this conference, there were 14 DiGAs listed that can be prescribed and reimbursed in Germany. (The full list of DiGAs can be accessed here: https://www.bfarm.de/EN/Medical-devices/Tasks/Digital-Health-Applications/_node.html) Excitingly, outcomes included in DiGAs applications should show not only medical benefits (e.g., decreased arthritis pain), but also structural and procedural benefits (e.g., adherence to physical therapy).

We then heard from a series of three talks of research that used digital apps as interventions. First, Sandra Hauser-Ulrich of Zurich University of Applied Sciences presented on her research on SELMA, a chatbot that leads patients with chronic pain through 8 weeks of digital coaching (rule-based intervention following a script).[9] A total of 61 patients completed the intervention with an adherence ratio of 71%. The chatbot was deemed acceptable based on individual patient experiences and recommendations. There were small effects for pain intensity and moderate effects for general wellbeing, but no significant differences between intervention groups. Next, Dr. Jutta Richter of the University Hospital Düsseldorf presented data on her team's longitudinal feasibility trial (n=43) in RA patients aimed at gathering patient usability and experience from their institution's app RheumaLive (rebranded to RheCord).[10] Results revealed that electronic PROs were reliable, as there were no significant differences compared to paper-based versions. Additionally, 84% of patients preferred electronic over paper-based versions, and 92% said they were easy to use. Therefore, this app was deemed acceptable and feasible. It was also well adopted by physicians, who said the app helped them assess the course of the disease (41%) and contributed (partially) to increase in adherence to therapy in seven patients. (Importantly, this outcome is one of the structural/procedural outcomes that Julia Hagen

mentioned can be used in DiGAs applications). Third, Dr. Yvonne Lee of Northwestern University in the United States presented a 24-week trial on a digital app for RA patients.[11,12] The idea of the app was to identify flares between clinic visits, thereby connecting the patient with their provider and resulting in a change in medications or care. Overall adherence was strong with 80% response rate. Although there were no differences in 6-month outcomes of patient satisfaction, perception of patient-provider interaction, or disease activity, the group that was provided the app did report more flares, as hypothesized, largely due to the tracking feature within the app.

During the discussion during this session, some emerging themes included the following:

a. 'One size fits all' approach is unlikely to work for digital apps
B. It is important to precisely define your study or target population
c. Digital app interventions can be more complex than drug or device interventions.

Dr Julia Hagen stressed the importance of keeping the patient at the center of the efforts in digital app development and research, since apps require a great deal of effort and engagement from the patient. Julia reminded us that if a digital app is not being used, we can be sure that it is not effective!

The session closed with an exciting presentation from Saemundur Oddsson, cofounder and CEO of Sidekick Health, a research-driven data-driven, and patient-centered platform for digital care with gamification to better engage patients and improve outcomes. In collaboration with Pfizer, Sidekick Health is launching a platform specific to RA patients. At the time of this meeting, Sidekick Health is actively rolling out the RA program. Research has begun using real-world data (i.e., individuals self-enroll) in Finland. At the 6-week interim analysis (of a 16-week program), 329 participants have enrolled and reported physical activity for at least 2 days in the first week. Interim analyses show that participants are demonstrating improved sleep quality, increased energy levels, and decreased stress.

Social Media

More than half of the world population use mobile devices with a large percentage of those using social platforms as a means to communicate. As such, the Digital Rheumatology Network considered social media to be a key pillar of this conference.

Dr. Paul Studenic from Karolinska Institute in Sweden kicked off the session with an excellent overview of the state of social media, followed by a presentation of his research on social media use in patients with rheumatologic diseases. Together with his team, Dr Studenic is conducting an ongoing international patient-partnered survey project distributed through social media, EULAR, national organizations, and outpatients clinics throughout several European counties in both 2018 and 2021. The percentage of survey respondents using social media for health-related purposes was 70-75%, with Facebook being the preferred platform. Most respondents started using social media for health-related purposes in order to connect with others going through their health condition, which was also reported as the largest advantage of social media use for health-related purposes. The biggest concern with social media was confidentiality and sharing of sensitive information. Interestingly, 15-20% started using social media for more info about their rheumatic conditions since COVID-19. Dr. Studenic concluded his talk with suggestions from patients on how to improve social media for health uses. These included more accessible information from official sources, lay language, fact check system, and more presence from experts.

These suggestions led nicely to the next talk by Dr. Latika Gupta of the Sanjay Gandhi Institute of Medical Science in India. Dr. Gupta also serves as the APLAR Webmaster and Social Media Editor for several medical journals. In her talk, she presented a series of recommendations and provided several tools to make use of social media in rheumatology more effective. Dr. Gupta views social media as the new frontier to communicate science and healthcare to patients with rheumatic diseases. With the movement toward more dissemination of research on social platforms, it is as important as ever to also tackle misinformation on social media platforms. Infographics are a great way to do so. They tell a story in a well-structured manner, convey key messages better, and can be disseminated rapidly (within hours). Infographics must be concise, self-explanatory, and use pictures and flowcharts. When using infographics, though, it is important to be thoughtful in the images chosen and to ensure that they are not infringing on copyrights.

Lastly, Dr. Martin Krusche of the Charite Hospital in Berlin, Germany provided an introduction and brief overview of Youtube for use in rheumatologic care. It is well known that

Youtube is most often used as a platform for information, and it became increasingly used for health information during the COVID-19 pandemic. There is scientific evidence showing that Youtube can provide high quality information, but Dr. Krusche acknowledges that information is only useful when knowledge can be turned into action. An example specific to rheumatic patients is getting patients to engage in physical activity after learning about its benefits on Youtube. Dr. Krusche concluded the talk covering the advantages (ease of access, availability, low costs) and disadvantages (no supervision, loss of personal motivation, risk of injury) that must be considered if you are going to make use of therapeutic short videos on Youtube.

Abstract Session

Prior to the conference, the Digital Rheumatology Network released a call for applications for scientific abstracts addressing digital topics in rheumatology. Three abstracts were selected for presentation during this session. The first abstract presentation was on the topic of AI from computer scientist Prof Boluwaji Ade Akinnuwesi of the University of Eswatini in Swaziland. (Blessing Adegbite of the Federal Institute of Industrial Research Oshodi in Nigeria was not able to be in attendance.) Prior to conducting the presented study, Akinnuwesi and Adegbite identified a crucial need for digital solutions in Nigeria, given the limited number of rheumatologists there (40 for 200 million people). They presented on the development of a decision support system for diagnosing rheumatic musculoskeletal disease using the fuzzy cognitive map technique. The goal was to test and evaluate model performance using real life data. Ultimately, the model displayed 87% accuracy, 90% sensitivity, and 80% specificity, indicating its potential as an AI tool for diagnosing rheumatologic diseases.

Next, Dr. Francisco Nunes of Fraunhofer Portugal AICOS in Porto, Portugal presented his team's preliminary plans for the COTIDIANA project. The goal of this project is to develop a market mobile solution that enables holistic and efficient monitoring for care and clinical trials in patients with rheumatic conditions. Dr. Nunes presented some really innovative outcomes for patient monitoring. These outcomes included touch events (speed of typing, errors, and speed of swiping) to gather data on hand dexterity in a passive manner; movement sensors (number of steps, step length, activity times) to gather activity data; and communication logs (number of calls, text messages etc.) to analyze sociability patterns that will help researchers better understand the mental status of patients.

The last presenter of the abstract session, Dr. Catherine Raptis of the SCQM Foundation in Switzerland, presented preliminary results of studies on COVID-19 using the Swiss Clinical Quality Management Foundation (SCQM) database. The broad goal of these studies were to use remote care and digital instruments to facilitate and accelerate data collection and patient communication. The mySCQM app provided patients with monthly reminders to answer questions on medications and disease progression. It also assisted them with self-administering blood tests. First, researchers sought to understand the proportion and risk factors of rheumatic patients with COVID-19. Over 3000 patients have answered the COVID-19 questionnaire at least once, and the overwhelming majority were satisfied and willing to participate in future data collection. Therefore, the second study sought to understand the immune response in patients with rheumatic disease receiving the COVID-19 vaccine. To date, 900 patients have participated in blood draw for antibody testing. Dr. Raptis noted that setting up the mySCQM app took over 1600 hours and a large budget, but patient response and uptake have been excellent.

Pitching Session

The last session of the 3rd Digital Rheumatology Day was the pitching session for innovative digital solutions in rheumatologic healthcare. It gave providers and app developers a competitive opportunity to give 3-minute elevator pitches of their digital care solutions. It also provided a means to connect companies with researchers interested in pursuing clinical trials with the digital care solutions. Attendees heard from pitches from the follow seven companies:

- Praxis Concierge Software (https://praxisconcierge.de/) presented by Simon Kuttruf
- Aison Technologies AG (www.aisontechnologies.com) presented by Dr. Sophia Borowka
- Elsa Science (https://www.elsa.science/en/) presented by Pelle Frank and Lars Kalareskog
- Mymee (https://www.mymee.com/) presented by Dr. Nicole Bundy
- Vila Health (https://www.vila-health.com/) presented by Laura Korcik
- ABATON GmbH (https://www.abaton.info/) presented by Manuel Grahammer
- YOGI Therapy presented by Harriet Morf and Minh Tam Truong

Upon conclusion of the pitches, the attendees voted on the app that they thought had the best potential to improve quality of care in rheumatology. Votes were dispersed across all pitches, but with 39% of the votes, the winner of the pitching session was ABATON.

## OUTLOOK

The Digital Rheumatology Day will be continued as annual hybrid meeting with different locations The 4th DRD will be held in Berlin, Germany in 2022. The Digital Rheumatology Network continues to inform and connect the field. Of the currently <100 FDA-approved AI-based algorithms, most are related to diagnostic automatization in radiology and pathology, some of them also concerning musculoskeletal diseases. So far there is no approved algorithm for clinical decision support in rheumatology but it is likely to come in the near future. Similarly, only two of the so far available DIGAs address musculoskeletal disorders but not yet inflammatory diseases. The efficacy of algorithms and therapeutic apps will be topics of the near future that will be addressed by the digital rheumatology network.

## ACKNOWLEDGEMENT

We acknowledge Dr. Jennifer Hunnicutt of Hunnicutt Writing and Consulting, LLC for her assistance with writing this meeting report.

## **REFERENCES**

1. Lechtenboehmer CA, Jaeger VK, Kyburz D, Walker UA, Hugle T. Brief Report: Influence of Disease Activity in Rheumatoid Arthritis on Radiographic Progression of Concomitant Interphalangeal Joint Osteoarthritis. *Arthritis Rheumatol.* 2019;71(1):43-49.
2. Vodencarevic A, Tascilar K, Hartmann F, et al. Advanced machine learning for predicting individual risk of flares in rheumatoid arthritis patients tapering biologic drugs. *Arthritis research & therapy.* 2021;23(1):67.

3. Rech J, Hueber AJ, Finzel S, et al. Prediction of disease relapses by multibiomarker disease activity and autoantibody status in patients with rheumatoid arthritis on tapering DMARD treatment. *Ann Rheum Dis.* 2016;75(9):1637-1644.
4. Haschka J, Englbrecht M, Hueber AJ, et al. Relapse rates in patients with rheumatoid arthritis in stable remission tapering or stopping antirheumatic therapy: interim results from the prospective randomised controlled RETRO study. *Ann Rheum Dis.* 2016;75(1):45-51.
5. Dejaco C, Alunno A, Bijlsma JW, et al. Influence of COVID-19 pandemic on decisions for the management of people with inflammatory rheumatic and musculoskeletal diseases: a survey among EULAR countries. *Ann Rheum Dis.* 2020.
6. Muehlensiepen F, Knitza J, Marquardt W, Engler J, Hueber A, Welcker M. Acceptance of Telerheumatology by Rheumatologists and General Practitioners in Germany: Nationwide Cross-sectional Survey Study. *Journal of medical Internet research.* 2021;23(3):e23742.
7. Muehlensiepen F, Mucke J, Krusche M, et al. The virtual fishbowl: bringing back dynamic debates to medical conferences. *Ann Rheum Dis.* 2020.
8. Seppen BF, den Boer P, Wiegel J, et al. Asynchronous mHealth Interventions in Rheumatoid Arthritis: Systematic Scoping Review. *JMIR mHealth and uHealth.* 2020;8(11):e19260.
9. Hauser-Ulrich S, Künzli H, Meier-Peterhans D, Kowatsch T. A Smartphone-Based Health Care Chatbot to Promote Self-Management of Chronic Pain (SELMA): Pilot Randomized Controlled Trial. *JMIR mHealth and uHealth.* 2020;8(4):e15806.
10. Richter JG, Nannen C, Chehab G, et al. Mobile App-based documentation of patient-reported outcomes - 3-months results from a proof-of-concept study on modern rheumatology patient management. *Arthritis research & therapy.* 2021;23(1):121.
11. Lee YC, Lu F, Colls J, et al. Outcomes of a Mobile App to Monitor Patient-Reported Outcomes in Rheumatoid Arthritis: A Randomized Controlled Trial. *Arthritis Rheumatol.* 2021;73(8):1421-1429.
12. Wang P, Luo D, Lu F, et al. A Novel Mobile App and Population Management System to Manage Rheumatoid Arthritis Flares: Protocol for a Randomized Controlled Trial. *JMIR research protocols.* 2018;7(4):e84.