🌐 Congress Interview

EMJ spoke to Nico Bruining, Chair of the European Society of Cardiology (ESC) Digital Health Committee, and Allan Böhm, Chair of the ESC Committee for Young Cardiovascular Professionals, about a range of pertinent topics, including the importance of digital health approaches for the prevention and management of cardiovascular diseases.

Featuring: Nico Bruining and Allan Böhm

Nico Bruining

European Society of Cardiology (ESC) Digital Health Committee Chair; Associate Professor, Thoraxcenter, Department of Cardiology, Erasmus University Medical Center, Rotterdam, the Netherlands

Q1 What does your role as Chair of the European Society of Cardiology (ESC) Digital Health Committee (DHC) entail and what have been your greatest achievements to date in this position?

To be precise, Martin Cowie, King's College London, UK, was the inaugural chair of the DHC from 2018 until earlier this year, when he changed his primary position. I covered the position until the biannual change of leadership of the ESC, which always occurs after the annual ESC Congress. I was, and will be for the 2022–2024 period, the Vice-Chair of the DHC, and I am also the Editor-in-Chief of the *European Heart Journal – Digital Health*. The new Chair from September 2022 will be Gerd Hindricks, University of Leipzig, Germany. I am very excited to be working with him and the other members of the DHC within this new mandate.

In 2016, we published a position paper on digital health (DH),[1] which led to the installation of the DHC. At the time, it was called eHealth. The position paper included a roadmap with an action plan for the ESC. The main actions were to organise a digital summit, which occurred in Tallinn, Estonia, bringing together different stakeholders, including industry, hospital information and technology departments, managers, insurance companies, patients, etc., to develop guidelines and add DH as a topic with its own sessions to the annual ESC Congress.

The Digital Summit was a great success. Unfortunately, it had to be online for the

ESC 2022

2 years thereafter because of COVID-19. The DH sessions at the annual ESC Congress are getting more and more successful each year. Guidelines have been created and more will follow soon, such as on artificial intelligence (AI).

The last achievement I would like to mention was the addition of the *European Heart Journal – Digital Health* to the ESC's journal family. Amid the pandemic in November 2020, we launched the journal at the first online Digital Summit. I was honored to become the inaugural Editor-in-Chief.

"Remote monitoring is maturing, and developments of wearables and simpler noninvasive measurements are improving."

Q2 **The goal of the ESC is to reduce the burden of cardiovascular disease. In what ways can digital health interventions help achieve this?**

There are so many opportunities for digital interventions that we need to develop further in order to address challenges such as the pandemic, a shrinking workforce, and a growing elderly population, just to name a few. Remote monitoring is maturing, and developments of wearables and simpler noninvasive measurements are improving. Just look at smartwatches as an example.

In the hospitals, we mainly focus on secondary prevention with remote monitoring, but you see that the lifestyle industry is catching up and may be entering the medical market sooner or later. That could open the way for primary prevention if users adhere to the digital recommendations. Currently, this area is mainly led by big tech. However, there is a lot to gain by working together.

Q3 At ESC Congress 2022, you co-chaired several sessions on the topics of e-Cardiology, DH, AI, and machine learning. Please could you provide an overview of these sessions and the key take-home messages?

DH was prominent at the conference this year. I actually missed a lot of DH presentations because they spread across the subspecialties and there were many parallel presentations. DH is now everywhere and not just on the special stages we had before the pandemic.

DH covers a wide range of topics, and AI, remote monitoring, and risk prediction are currently the most intensively researched subtopics. A complete overview of all DH presentations would require an entire book. For those interested, the sessions can be viewed via ESC 365.[2]

Hotline session six was completely focused on DH and presented three exciting and typical studies for current DH developments, including smartphone-based screening for atrial fibrillation (eBRAVE-AF),[3] a pragmatic siteless digital randomised clinical trial by Axel Bauer, University of Innsbruck, Austria. The findings of this digital trial indicate that a scalable digital screening using ordinary smartphones provides a substantial benefit to usual care in detecting treatment-relevant atrial fibrillation.

Causal AI substantially improves the validity of estimating cardiovascular risk and benefit,[4] as presented by Brian Ference, University of Cambridge, UK. The outcome of this study was to train AI algorithms to estimate the causal effects of modifiable targets of intervention in a way that reflects the underlying biology of how disease develops. This was achieved by using randomised evidence, introducing a method to create causal AI algorithms that accurately predict risk and benefit, and prescribing specific actions to reduce risk.

> **"DH covers a wide range of topics, and AI, remote monitoring, and risk prediction are currently the most intensively researched subtopics."**

The final presentation was by Geoffrey Strange, University of Sydney, Australia, who established a national echocardiographic database that enabled AI to develop a risk predictor capable of identifying patients with moderate-to-severe aortic stenosis with poor survival if untreated with an improved accuracy compared with traditional methods.

These three studies illustrate current developments in cardiovascular disease DH, with remote monitoring using noninvasive measurement capabilities and improved risk predictors using AI. We will soon see much more of it at conferences and in the literature.

Q4 At ESC Acute CardioVascular Care 2022, you delivered a presentation on top trends in DH research for acute care. Please could you provide a summary your talk?

Acute cardiovascular care is a young and interesting subspecialty in cardiology. It is intended to include the period from the preclinical phase to the end of the first week of hospitalisation.

After a short general introduction to DH, I focused on developments that fit in with the main aim mentioned above, including using social media as a public screening tool, which was developed to track patient-reported symptoms of COVID-19 in the first wave, filtering that from Twitter messages. I also discussed digital systems that connect first responders with the cardiac catheterisation laboratory (cath lab)

staff all the way from the home, street, and ambulance until arrival in the cath lab. I spoke about AI-supported analyses of ECGs and electronic health record systems for the detection of ST-elevation myocardial infarction, coronary artery disease, rhythm disorders, and pulmonary embolisms. This is one method of expediting clinical decision making. In addition, I considered AI-supported image analysis, smart alarms in the intensive care unit, and facilitators and barriers to DH.

So, acute cardiovascular care can very well use the support of the above-mentioned DH systems. In addition, it is important that clinicians and other healthcare professionals make their needs known to the DH developers and the developers come into the clinic to see these needs and later assess how their systems and software perform.

Q5 **Please could you outline your involvement in the early developments of 3D echocardiography and discuss the wider relevance of your PhD thesis, entitled 'Quantitative 3-D echocardiography of the heart and the coronary vessels'?**
I could write a book around this, but I'll try to keep it shorter. My promotor, and then Chair of the Thoraxcenter (Erasmus University Medical Center,

Rotterdam, the Netherlands), the late Jos RTC Roelandt, an eminent echocardiographer, was intrigued by a 3D ultrasound system developed by a company called TOMTEC (Unterschleißheim, Germany). They introduced it to him when the system was not yet on the market. He sent me to this company to learn how to work with it and to introduce it later in the clinic. At the time, the system was complex to use and did not yet provide the high-quality four-dimensional (4D [3D plus time]) images you see today on the ultrasound machines. As an example, making a 3D reconstruction took almost an entire night.

The TOMTEC system was initially intended for 4D reconstructions of the whole heart. As I started to understand how it worked, and with my background in interventional cardiology, I conceived another use. Could we adapt it to make it suitable for 4D images of the coronary arteries as well? We succeeded by designing and building a special pullback device for intracoronary ultrasound catheters, which allowed us to acquire the image data and to visualise the coronary arteries with all their movements during the cardiac cycle, which was amazing.

In addition to imaging, quantification is especially important and in retrospect the most important part of my dissertation. By eliminating motion and deformation artefacts due to heart motion, more accurate measurements of coronary dimensions and the plaques or other structures within them could be made. This precise method of image acquisition and quantitative analysis has been used in many studies to evaluate new interventional therapies. These include the first drug-eluting stent in humans, progression–regression studies of atherosclerosis, and the bioabsorbable scaffolds. To date, this method of ECG-gated acquisition and quantification is the most accurate.

"Firstly, AI can be used to improve the accuracy of measurements applied to imaging, which is typically echocardiography and cardiac CT for patients with AS."

Q6 How important is AI in delivering precision medicine to patients with aortic stenosis (AS)?

Firstly, AI can be used to improve the accuracy of measurements applied to imaging, which is typically echocardiography and cardiac CT for patients with AS. Secondly, AI can enhance risk prediction using all available patient data. This could be performed when it is available in the electronic health record.

My belief is that this is not only true for AS but for many other pathologies, perhaps even for all. It can help with processing data as images and signals as well as data within the electronic health record system. This could provide clinical decision support and ultimately lead to precision and personalised medicine.

Q7 How has the ongoing COVID-19 pandemic influenced the development of DH and telemedicine?

We have seen lots of developments battling the adverse effects of the pandemic. Often, telemedicine and DH provided solutions. Remote monitoring and consultations were perhaps the most widely applied. Remote proctoring was also a necessity for areas where patients could not travel to a treatment centre. Instead, local physicians were able to treat the patients locally with the help of remote experts. Many of these developments have been described in the literature. Sometimes it is referred to that the pandemic caused a 'techcelleration'.

Q8 You serve as Chair of the European Association of Percutaneous Cardiovascular Interventions (EAPCI) Innovation and Digital Cardiology Committee. What are your primary duties in this role?

I was the Chair from May 2020 until last May, when the leadership in the EAPCI changed. The primary tasks were actually not different from those of the DHC in the ESC, and that was to bring together enthusiasts of digital medical technology, in this case specifically for interventional cardiology. Organising topic-specific sessions for the various conferences in which the association is involved and discussing ideas or projects were among the primary duties.

Unfortunately, it was during the middle of the pandemic, and it was difficult to organise some things in-person. However, we did get some things done, such as sessions during the ESC DH meetings. We also launched two important surveys to establish consensus on complex percutaneous cardiovascular interventions and the use of virtual reality imaging, both of which are growing topics. The results are currently being analysed, and we intend that two articles will be produced. We have handed this over to the new committee, and I wish them the best of luck in their mission.

Q9 **Could you highlight the key conclusions from your 2021 review, 'Robotics, imaging, and artificial intelligence in the catheterisation laboratory'?**
Interventional cardiology, including electrophysiology, relies on complex technologies for diagnostics and therapy guidance, and we described the latest technological advancements using digital technologies in a state-of-the-art review article.[5]

The possibilities to treat patients more minimally invasively have increased enormously. Besides treating coronary arteries and structural heart disease such as aortic valve replacement, it has become standard practice over the past decade. This calls for additional diagnostics and instruments, where multimodal imaging is of great importance. Many improvements are still possible here, which we hope to achieve through the use of AI. We are currently seeing many developments around improved diagnosis and risk predictors.

In terms of instruments, surgical robots have already proven their worth in other specialties, such as the Da Vinci robot (Intuitive Surgical, Sunnyvale, California, USA) for prostate cancer surgery. There are currently developments in the cath lab to perform percutaneous coronary intervention procedures remotely by a robot. This is helpful for the cardiologist and other cath lab personnel because of a reduction in X-ray exposure. Perhaps soon, given the enormous developments in the robotics industry, they might also assist with more complex interventions such as percutaneous valve replacements.

Q10 **Have there been any recent innovations in the development of DH approaches for cardiovascular diseases prevention and management that you believe are particularly noteworthy? How might this field have evolved by ESC Congress 2023?**
I believe we are still in the infancy of the developments in DH. With AI, we are only on the surface. Although we started working with AI around the 1990s, the hardware and software were not yet ready for applications in the complex medical field. It was too complex and difficult to explain how the AI algorithms worked. Now, we see opportunities for developments around explainable and reliable AI. We need them to generate trust among users, regulators, and patients. This is crucial for the broad acceptance of these techniques.

DH is likely to grow rapidly in remote monitoring. The pandemic has accelerated both technology and adoption. Patients with post-myocardial infarction and individuals with heart failure would probably benefit from this. Building on this year's congress, I expect many more results from randomised studies where DH technology plays a major role.

References

1. Cowie MR et al. e-Health: a position statement of the European Society of Cardiology. Eur Heart J. 2016;37(1):63-6.

2. European Society of Cardiology (ESC). ESC 365 - the cardiology knowledge hub. Available at: https://esc365.escardio.org/home. Last accessed: 13 September 2022.

3. Rizas KD et al. Smartphone-based screening for atrial fibrillation: a pragmatic randomized clinical trial. Nat Med. 2022;DOI:10.1038/s41591-022-01979-w.

4. Steinfeldt J et al. Neural network-based integration of polygenic and clinical information: development and validation of a prediction model for 10-year risk of major adverse cardiac events in the UK Biobank cohort. Lancet Digit Health. 2022;4(2):e84-94.

5. Beyar R et al. Robotics, imaging, and artificial intelligence in the catheterisation laboratory. EuroIntervention. 2021;17(7):537-49.