



# Embracing AI to enhance quality of care in Denmark

Can we level up the standard of care in a sustainable way whilst also decreasing the cost of healthcare in Denmark? Can we reconfigure Radiology, putting artificial intelligence at the heart of delivery, to enhance patient safety and increase the patient experience? Are there tools available, which are proven both safe and effective, that can support our hard working Radiology staff to remove some of the burdens from their work or help with monotonous tasks? We believe that the answer to those questions is a resounding yes.

- 1: Mazurowski, M, 2019, Artificial Intelligence May Cause a Significant Disruption to the Radiology Workforce, <https://www.sciencedirect.com/science/article/abs/pii/S154614401930064X>
- 2: Raya-Povedano, J et al., 2021, AI-based Strategies to Reduce Workload in Breast Cancer Screening with Mammography and Tomosynthesis: A Retrospective Evaluation, <https://pubs.rsna.org/doi/full/10.1148/radiol.2021203555>
- 3: Sundhedsdatastyrelsen, 2021, Radiologiske undersøgelser, <https://www.esundhed.dk/Registre/Landspatientsregisteret/Radiologiske-ydelser>



## AI as a tool for MSK Radiology

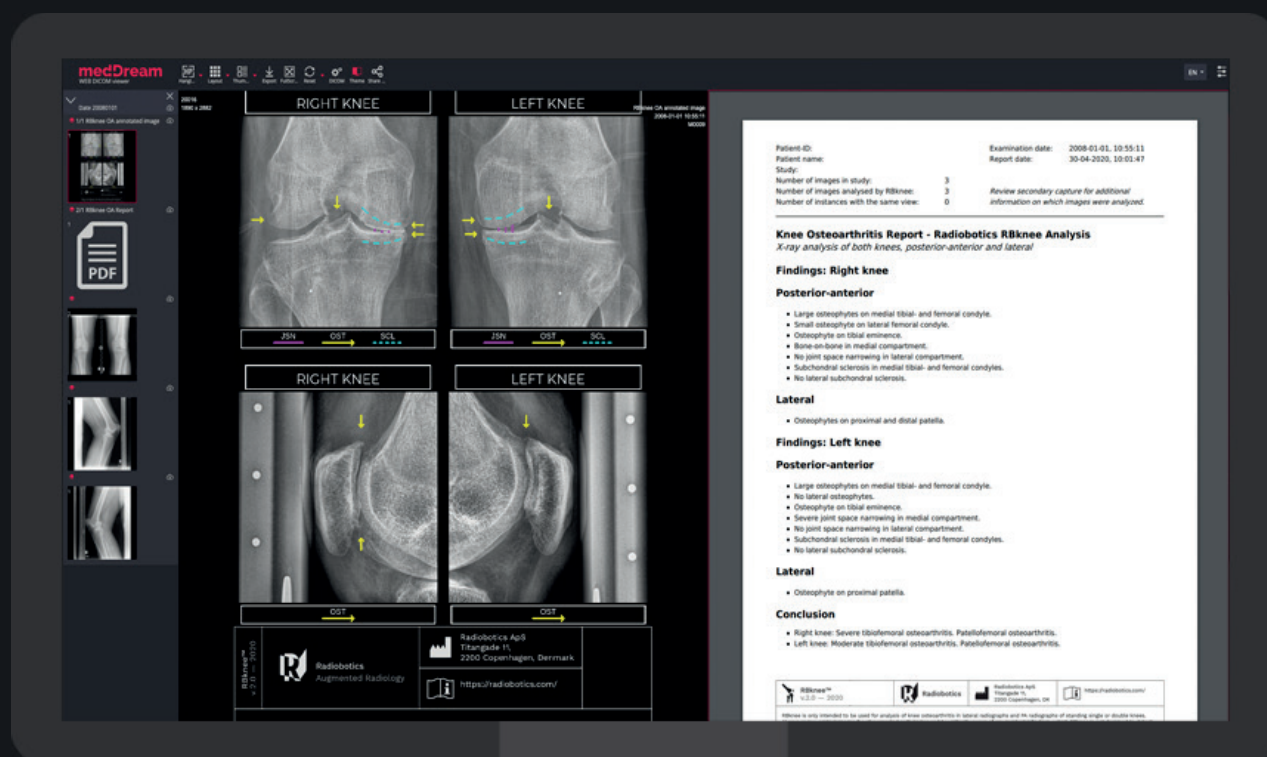
Radiologists' workloads are increasing dramatically, and we are finding that there is a decrease in the pool of Radiologists available in Denmark to undertake this work. How can we help this group of staff to enable them to more efficiently and effectively reduce their workload?

A consensus has arisen that AI will support radiologists in the interpretation of less challenging radiology cases, giving the radiologists and reporting radiographers more time to focus on the challenging tasks and interactions with patients and other clinicians<sup>1</sup>. AI has been shown to help reduce workload pressure for Radiology reporting staff<sup>2</sup>.

More and more products are available for the Danish and European market, which can be deployed to healthcare professionals caring for patients with musculoskeletal conditions, such as Radiobotics (DK), who is a global frontrunner in developing algorithms that can assist Radiologists & Reporting

Radiographers to report on their cases of musculoskeletal (MSK) radiographs. Their tools, such as RBknee, which automates the reporting of knee radiographs, can be used to potentially decrease the time it takes to report knee radiographic examinations. While at first glance, you may think that knee radiographs only make up a small percentage of Radiologists & Reporting Radiographers' workload.

In fact, in Denmark, almost 200,000 knee radiographs are taken each year<sup>3</sup> and each examination holds usually a minimum of 2 images, a posterior anterior view and a lateral view and sometimes also a skyline view. Each of these can take reporters between 1 to 5 minutes to report, depending on the case's complexity. AI can help here, RBknee for example, could reduce the time reporters spend analysing these images and creating a report. This time saving can be used on other critical issues, such as reporting on suspected cancer cases.



One of the strengths of AI is that it is “always on”, AI does not have a “bad day”, its performance will not deviate if it has only had 2 hours of sleep. This consistency is greatly appreciated in a Radiology department, where many reporters are working long hours or covering night shifts. The “second pair of eyes” that AI provides is greatly received during the day and night.

Equity of care is also a driving force for the use of AI in Radiology. Patients should have access to the same standard of care whether they live in metropolitan Copenhagen or a rural setting. Products such as RB-knee, which Radiobotics offers, can be used to “level the playing field”. While hospitals in rural locations may not have access to the same breadth

of staff as metropolitan areas, patients expect the same quality of care from these centres as they would in i.e Copenhagen area. RBknee’s performance is not dependent on which location it is deployed at; it can bring quality for radiology departments around the country.

Speaking to Radiologists and Reporting Radiographers in Denmark and beyond, we know that this profession is under a lot of pressure. The amount of vacancies for Radiology / Reporting Radiographer positions is increasing in departments across the country and there is evidence that some of the reasons for this could be due to early retirement of staff or staff leaving the workforce prematurely due to stress and burnout.



Professor of Radiology at Copenhagen University Hospital Bispebjerg and Frederiksberg and co-founder of Radiologic AI-testcenter (RAIT.dk) Mikael Boesen and collaborator with Radiobotics said:



"In radiology the last 10 years we are seeing 10-15% annual increase number of complex 3D examinations (MRI and CT scans) per patient visit per year, with doubling of the data size every 2-4 years and we educate only 2-4% more radiology specialist per year. On top of that today we have 20-30% vacancies of specialist positions within radiology in Denmark and with the current educational projections we will in 2040 be 30-40% more radiologists than today. Doing the math of the above numbers it is painting a scary picture of the near future for Radiology unless we open up for using smart technology like the one Radiobotics offers to help save time for reading conventional and less complicated cases with low risk so we can gain time to spend on the increasing numbers of more complex scans with higher risks."



## What is RAIT?

The radiological artificial intelligence testcenter (RAIT) is a collaboration between the departments of radiology at Herlev, Gentofte, Frederiksberg and Bispebjerg Hospital. The collaboration combines the experience of the radiological Innovation unit at Herlev Hospital with an active research section at Frederiksberg and Bispebjerg Hospital.

The involved departments wish to establish a common foundation for the development, clinical validation and implementation of artificial intelligence tools in the radiological departments in the capital region of Denmark (Region H).

## Why an Artificial Intelligence collaboration?

AI projects in radiology are limited by the digital infrastructure. This is true for AI project which aim to develop new algorithms, clinically test prototype algorithms or implement validated algorithms in clinical practise.

The limitations include data access, data quality and known barriers to implementation.

The solution is a testcenter, which solves the logistical aspects of AI test and implementation, so that researchers and clinicians can focus on what they are best at: making sure that AI in radiology creates value for patients.

Standardisation in reporting has long been argued for but has been elusive. Reporters often have individual reporting styles, and there are longstanding disagreements between reporting staff on what this standard of reporting should look like. Radiology AI tools, like the ones offered by Radiobotics, provide standardised reporting. This unlocks many benefits for readers of radiology reports, most importantly, increasing the interpretability of radiology reports, which has benefits for referring and treating clinicians.

Standardisation in reporting also enables efficiency savings for healthcare systems in Denmark as elsewhere. Hospitals in Denmark can reduce outpatient appointments and inappropriate referrals throughout the system by correctly

triaging patients the first time simply by digitizing and standardizing disease classification grades on plain radiographs which can be used to make smart referrals based on national clinical guidelines. Although this problem is by no means unique to Denmark, it results in tax-payers money being funneled to practises that are not optimal.

This concept is widely recognized and one of the reasons for the “choose wisely campaign world-wide” that states that up to 20-30% of our healthcare examinations and treatments are redundant<sup>4</sup> meaning “not needed”. RBknee, has a standardised report, and can enable us to get it right, the first time. This has a big impact on the workload of our hardworking healthcare professionals and more importantly on the patient's experience.

4: LVS, 2021, Chose Wisely Campaign, <https://selskaberne.dk/temaer/vaelg-klogt>



An example of where RBknee can enable value creation for both patients and Danish hospitals is through the AI-KOA program, which is being undertaken by Bispebjerg Hospital and Frederiksberg Hospital and Radiobotics. This program is unique in that it aims to streamline the diagnostic path for patients and quantify the savings that can be generated by using RBknee to reduce the need for unnecessary and expensive MRI scans. Patients with knee pain, who are also at high risk of suffering from osteoarthritis, will be allocated to a fast-track for diagnostic workup with same-day bookings of conventional radiographs and MRI examination.

RBknee will be deployed in a way that can allow Radiographers who are taking the radiographs to use RBknee's standardised report to determine if the patient needs to have the afternoon MRI. It is thought that the number of patients who will have an unnecessary MRI will decrease.

For hospital systems, this translates into cost savings. More importantly, patients can avoid an MRI scan, which is a diagnostic intervention that can cause distress for some patients.

And for patients who do need an MRI, it means a correct diagnosis faster, without having to attend to the hospital twice.





We spoke to Professor Mikael Boesen, MD, PhD, MSK Consultant Radiologist and Head of Research at the Radiology Department at Bispebjerg Hospital and RAIT.dk. Prof. Boesen sees the value which can be created by leveraging AI in Radiology. He mentions that he hopes that the time which can be freed up from the AI-KOA program can enable

the MRI machinery at Bispebjerg to bring down the waiting lists for MRIs that exist, not just in the capital region but across Denmark. He believes that access to standardised reports can take the ambiguity out of Radiology reporting, which can only be a good thing especially for automated workflow optimisations tasks.

## Conclusion

AI can bring significant value for Radiologists and Reporting Radiographer in Denmark to enhance the quality of care. Tools, such as RBknee, can be deployed to reduce costs and increase the patient experience with potential hospital savings. This tool has been cleared by CE and is deemed not only safe but effective. As shown by the X-AID and AI-KOA projects, these products are available now and can provide significant value for us all in Denmark and beyond.

Radiobotics is an AI software company located in Copenhagen, Denmark, with a focus on developing algorithms for hospitals to automate reading of x-rays of bone and joints.

Lately Radiobotics has experienced strong traction, won multiple awards and grants, and established noticeable international collaborations. Radiobotics has 20 employees, comprising a diverse and highly skilled team, with expertise especially within machine learning and artificial intelligence (AI), software development, health-care IT system integration, clinical studies and evaluations, regulatory affairs and quality assurance.

All necessities for creating ‘software-as-a-medical-device’ under given regulations.