



Case Study Series

Radiology of the future – Overview

Issue 1

Defining trends in radiology and
practical examples of implementation

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Executive Summary

This overview paper introduces defining trends in radiology. It is the starting point of a following four-part series that will cover these trends in detail and in a very practical way. Goal is to present practical examples of implementation that give the reader not only an idea of future developments but also of the implementation itself. The four areas of change will cover Patient Experience & Healing Infrastructure, Value-based Radiology & Patient Journey, Networked Care, and Digital, Data & AI.

“To provide our patients with the best possible diagnostics and treatment, we need a network of innovative minds that drive innovation at various levels. This is exactly what we at KSB – together with our partner Siemens Healthineers – stand for.”

Adrian Schmitter, CEO Kantonsspital Baden AG (KSB)



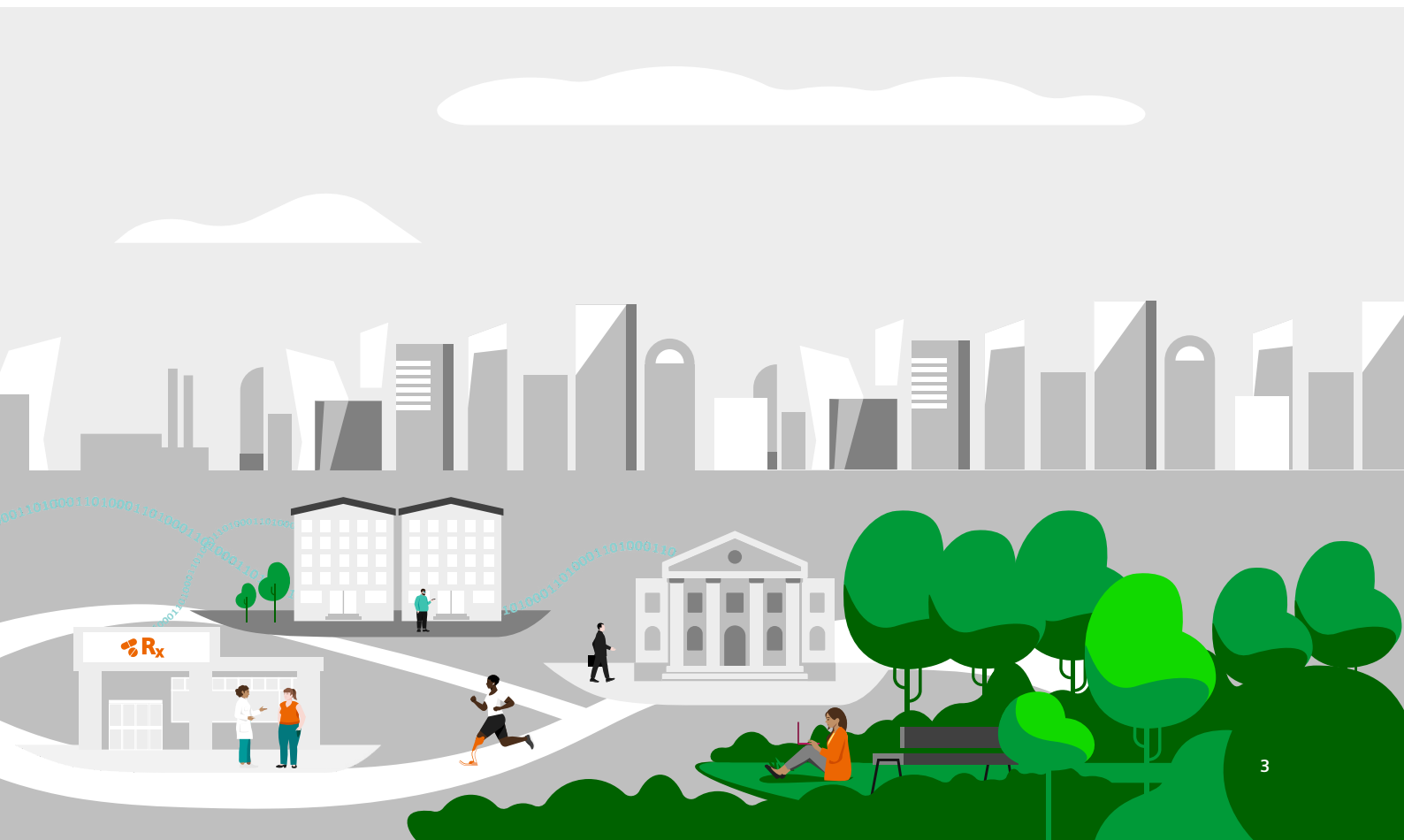
Scientific advancements and technological developments in imaging have the potential to fundamentally transform radiology today and even more in the upcoming decade. Precision medicine and care delivery will be shaped by innovative technologies in the area of robotics, automation and Artificial Intelligence (AI). Furthermore, accuracy will be boosted by virtual and augmented reality and the use of quantitative imaging biomarkers instead of morphologic assessment only. In the future, integrated decision making along the clinical pathways with interdisciplinary care teams with expertise for a specific clinical problem or episode of healthcare will become even more important.

However, as immense as this prescribed future potential might be, it should not prevent us from facing realities in today's radiology departments. The level of digitization and automation lags behind in many institutions already

today. In a sample from 58 leading institutions (across 18 countries) only one third of the institutions made diagnostic images or reports accessible via electronic platforms, such as patient portals. In addition, the use of structured reporting has been reported to represent rather the exception than the rule. Automated evaluation or pre-interpretation of conspicuous structures by AI is just now being implemented into clinical practice.¹

These developments shaping the future of radiology might be divided into four categories (Figure 1): **Patient Experience & Healing Infrastructure, Value-based Radiology & Patient Journey, Networked Care and Digital, Data & AI**. These four trends certainly cannot be considered comprehensive or exclusive on their own, but together they have the power to fundamentally change the landscape of radiology.

¹ European Society of Radiology (2019). IT development in radiology – an ESR update on the Digital Imaging Adoption Model (DIAM). [Link](#).



Patient Experience & Healing Infrastructure

In addition to medical care in the strict sense, topics that go beyond the outcome focus, such as patient experience or care team experience (human experience) will become increasingly important in the future. In this context, the term Healing Architecture has gained acceptance.² Both the macroscopic layout and the interior design elements have to be considered. The infrastructure should support the well-being of the patient, e.g., providing comfort in the waiting lounge, decreasing anxiety in a high-tech environment, and reducing claustrophobia during the MR exam. Besides that, the infrastructure should support the efficiency of the processes, for example by integrating patient preparation areas before the exam. Furthermore, the infrastructure is again closely linked to digital solutions such as check-in terminals, patient monitors and visual process management, allowing for patient information, reduced waiting times and access to results.

Another important element of infrastructure in our outlook is the increasingly important ecological footprint. It is no longer acceptable that facilities act in an unsustainable way, regardless of energy consumption, waste of resources and recyclability. Providing radiologic care locally, with a “hub and spoke” concept, e.g. hospitals and dedicated outpatient centers – which will further contribute to a sustainable radiology environment.

Value-based Radiology & Patient Journey

When talking about expertise and the stronger focus on patients and their outcomes, one cannot avoid talking about value-based medicine and, in particular, value-based radiology. The ultimate goal should be to further improve individual healthcare outcomes without ever-increasing costs. Radiologists aim to provide the best possible quality and service for the patient and referring physicians around the clock. But a radiology department should also act as a technology gate keeper in charge of operational efficiency. All investigations and interventions have to contribute positively to patients’ outcomes.

Clinical patient pathways, a stronger focus on inter-sectoral patients flows and the increasing consolidation in expert teams must also be taken into account in radiology. Thus, it makes sense to divide modern departments into organ competencies/ care teams (neuroradiology, cardiac, abdomen, musculoskeletal, women’s health, etc.) and no longer into equipment responsibilities (magnetic resonance imaging, computed tomography, etc.). The strategic orientation is no longer seen only intra-departmentally but as an interdisciplinary care team along the patient journey allowing for an optimized workflow with operational excellence. Information consolidation (imaging, pathology, laboratory and genetic data etc.) will allow for integrated diagnostics and personalized medicine.



² Frandsen, A. K., Mullins, M., Ryhl, C., Folmer, M. B., Fich, L. B., Øien, T. B., & Sørensen, N. L. (2009). *Helende arkitektur*. Aalborg: Institut for Arkitektur og Medieteknologi. Institut for Arkitektur og Design Skriftserie, No. 29.

Networked Care

Profound changes in and to the system also make it necessary to reflect on organizational and operational structures and to critically examine their validity and functionality. Therefore, it is essential for this trend to understand current changes in the health sector, define future goals and constructively close the gaps to achieve them. For example, there is an increasing consolidation of medical care institutions, and a stronger outpatient care of patients is becoming more and more important.

Radiology must prepare itself for this, for example through closer integration with internal stakeholders (as part of the described patient pathways), referring organizations, payers and, of course, the patients themselves. Thus, radiology networks, consisting of hubs and spokes, will contribute to the quality and cost-effectiveness of radiology care in the future.

This also allows radiology institutions to achieve the critical size of personnel for 24/7/52 emergency care, organ specialization as well as sufficient case volume for imaging-guided interventions assuring high quality as well as radiologist training.

“With this practice-oriented publication we share our vision of the future of radiology and would like to encourage our colleagues to make sure that radiology will continue to thrive in the next decade.”

Prof. Rahel Kubik, Head of the Institute of Radiology

Digital, Data & AI

Modern medicine has always been based on evidence, in other words data that has been collected and analyzed in a structured way. This principle has proven itself in patient care and is now increasingly finding its way into the non-medical areas of the healthcare sector. Based on data, strategies for national and regional care are developed. Capacities are planned and demands are intelligently managed.

Big data analytics, integrating and analyzing large amounts of complex imaging, biomedical and electronic healthcare data has gained and will continue to gain importance in medicine and Artificial Intelligence will increasingly be used to support radiologic diagnosis and treatment decisions.

“It’s not about replacing physicians, but rather, combining the strengths of physicians and AI. That’s why our AI solutions are called Companions.”

André Hartung, President of Diagnostic Imaging

Conclusion

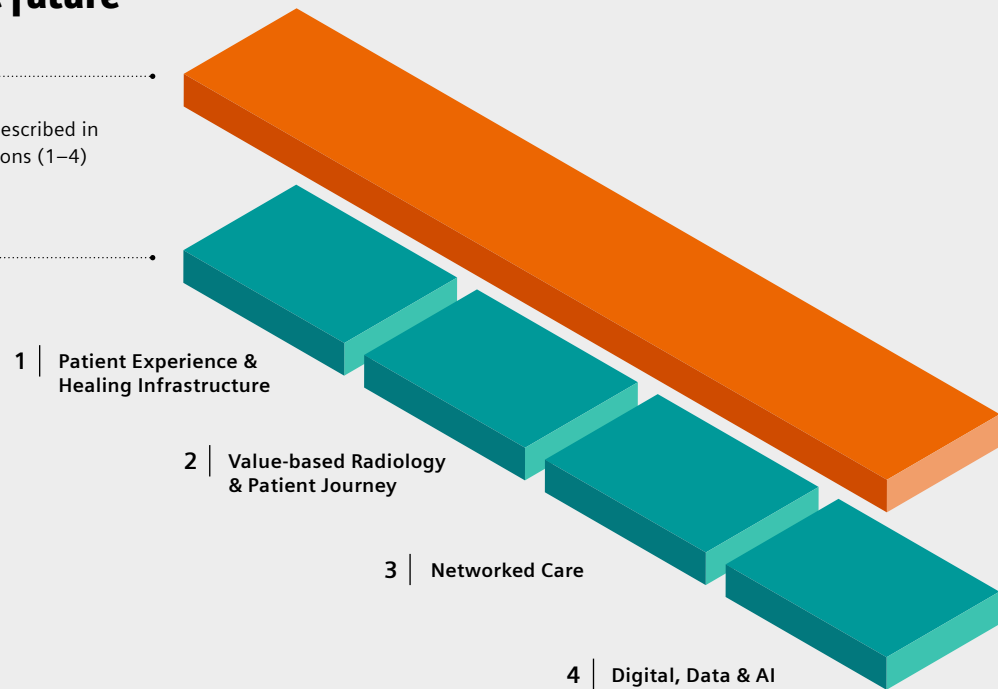
With this subsequent series of four compact and explicitly practice-oriented publications, we want to shed light on the different thematic fields and changes in radiology and make them accessible to you, the care team. In doing so, we have placed particular emphasis on using concrete examples to illustrate the transformation and, above all, the positive influence. As shown in Figure 1, we have chosen Networked Care, Value-based Radiology & Patient Journey, Healing Infrastructure and Digital, Data & AI as the main topics. The individual publications can be read and understood on their own and as a whole provide a holistic picture of current trends in radiology.

Radiology of the future

Overview paper

outlining the radiology trends described in detail in the individual publications (1–4)

Trends in radiology



Patient Experience & Healing Infrastructure

- Layout design
- Human experience
- Ecological footprint & Sustainability

Value-based Radiology & Patient Journey

- Interdisciplinary Cooperation
- Clinical pathways
- Workflow optimization

Networked Care

- Hub & spoke
- Access to care
- Teleradiology & Virtual care

Digital, Data & AI

- AI decision making
- Radiomics & precision medicine

Figure 1: Overview of the individual papers in our *Radiology of the future* publication series

“Radiology is in a constant state of flux, which is especially driven by the proximity to technology. As a consultant and collaboration manager it is fascinating to accompany the different approaches to these new challenges, to help design solutions and to share the international experiences with our worldwide customers and colleagues.”

Karl-Philipp Kienle, Clinical Consultant and Collaboration Manager

About the authors



Prof. Rahel Kubik
Head of the Institute of Radiology

Professor Rahel Kubik is Head of the Institute of Radiology and Chair of the Department of Medical Services and member of the executive board at the Kantonsspital Baden in Switzerland, a teaching hospital affiliated with the University of Zurich and the Swiss Federal Institute of Technology ETH. She was trained at the Rockefeller University Hospital New York and the University Hospital Zurich and earned her medical degree, doctorate, and habilitation from the University of Zurich. In 2004, she received a Master of Public Health. She has a strong interest in female imaging with expertise in all imaging modalities and imaging-guided minimal invasive breast interventions as well as management topics and research.



Karl-Philipp Kienle
Clinical Consultant and Collaboration Manager

Karl-Philipp Kienle has been a clinical consultant and project lead for [Value Partners for Healthcare Consulting](#) since 2016. Moreover, he is clinical collaboration manager for X-ray products. He has deep knowledge in the field of pathway, process and workflow optimization as well as layout adaption. Besides, his expertise lies in the field of clinical strategies and digitalization in the healthcare sector. Karl-Philipp is a medical doctor trained in Erlangen, Bernese and Boston. After completing his post-doctoral fellowship in Berne in 2013, he worked as a physician in the academic Ear-Nose-Throat Department at Wuerzburg University Hospital.



Adrian Schmitter
CEO Kantonsspital Baden AG

Adrian Schmitter has been CEO of the Kantonsspital Baden for over 7 years. He completed an engineering degree as an agronomist and studied law and economics at the Universities of Neuchâtel and Freiburg. During his career, he drove innovation in different positions in the healthcare sector. From 2001–2010 he was the Secretary General of the Department of Health and Social Affairs Canton of Aargau, before continuing his career as hospital CEO at Hospital of Emmental. In addition to his function as CEO at the Kantonsspital in Baden, he has held and continues to hold several board memberships. His ambition is characterized by the implementation of innovative ideas that ultimately serve society and patients.



André Hartung
President of Diagnostic Imaging

André Hartung has been the President of Diagnostic Imaging at Siemens Healthineers since 2019. After joining the healthcare business of Siemens as a product manager in 2001, he served in diverse management positions with increasing responsibility. André brings deep expertise in diagnostic imaging, having previously led the computed tomography team at Siemens Healthineers from 2015–2019. Prior to this role, he was the CEO of the X-ray products team for over four years. André studied medicine at Saarland University in Saarbrücken, Germany. In the late 1990s he was an assistant physician in neurology and psychiatry in Düsseldorf.

The products/features and/or service offerings (here mentioned) are not commercially available in all countries and/or for all modalities. If the services are not marketed in countries due to regulatory or other reasons, the service offering cannot be guaranteed. Please contact your local Siemens Healthineers organization for more details. The results described herein by customers of Siemens Healthineers were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption), there can be no guarantee that other customers will achieve the same results.

The scientific overlay on the title is not that of the individual pictured and is not from a device of Siemens Healthineers. It was modified for better visualization.

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