




EDIH
DigiCare

 Kofinanziert von der
Europäischen Union

Trend Radar

on Digitalization
in Healthcare

 bayern
innovativ
Gesundheit


MEDICAL VALLEY
Europäische Metropolregion Nürnberg



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While healthcare has long been a central priority for the EU, the COVID-19 pandemic has further emphasized the importance of a unified approach to public health. This unprecedented situation has demonstrated concrete ways in which the Union can support national policies to improve the daily lives and welfare of citizens, as exemplified by the EU Vaccines Strategy, which saved millions of lives across the continent. The pandemic also accelerated the need for digital solutions in the healthcare sector; the EU Digital COVID Certificate was a fundamental milestone in facilitating the reopening of European societies and international economic activity.

Digital technologies now play a crucial role in enhancing the effectiveness of the healthcare sector, with Artificial Intelligence (AI) being a prime example. AI is already making significant strides, particularly in medical diagnosis—increasing the accuracy of classifying fractures or pneumonia—and in drug discovery, accelerating clinical trial stages and improving the understanding of diseases to be cured. The recent advent of generative AI is also opening up vast possibilities for patient-centric medicine. The ability to derive insights and patterns from large amounts of patient data can drive more personalized treatments and enhance patient outcomes.

The European Commission welcomes the opportunities in the field of digital health and is committed to advancing modern and innovative health policies as part of the European Health Union. These policies draw on the innovative yet trustworthy application of cutting-edge technologies. An example of this commitment is the implementation of the European Health Data Space (EHDS), a transformative approach that leverages digitalization to empower patients, giving them better control and the ability to share their health data safely and more effectively. Additionally, with the upcoming Apply AI Strategy, the EU will focus on boosting new industrial uses of AI and improving the delivery of various public services, including healthcare. Furthermore, within the first 100 days of the new mandate, the European Commission will work on a European action plan for the cybersecurity of hospitals and healthcare providers.

To realize these ambitions, the work of European Digital Innovation Hubs, such as EDIH DigiCare, is essential. As one-stop shops across 30 European countries, EDIHs are key drivers of digital transformation, assisting local businesses and public administrations with testing and prototyping, funding opportunities, training, and innovative collaborations in various economic sectors. I commend EDIH DigiCare’s dedication to supporting the digitalization of the Bavarian and German healthcare sector and fully support their commitment to advancing digital health innovation, notably with their trend radar.

This report provides a unique analysis of Germany’s current digital health landscape and future outlook, offering invaluable lessons and inspiration for various stakeholders and interested parties. Moreover, by aligning local innovation with EU priorities, the report contributes to building a competitive, secure, and citizen-centric digital healthcare ecosystem that will eventually benefit all Europeans.

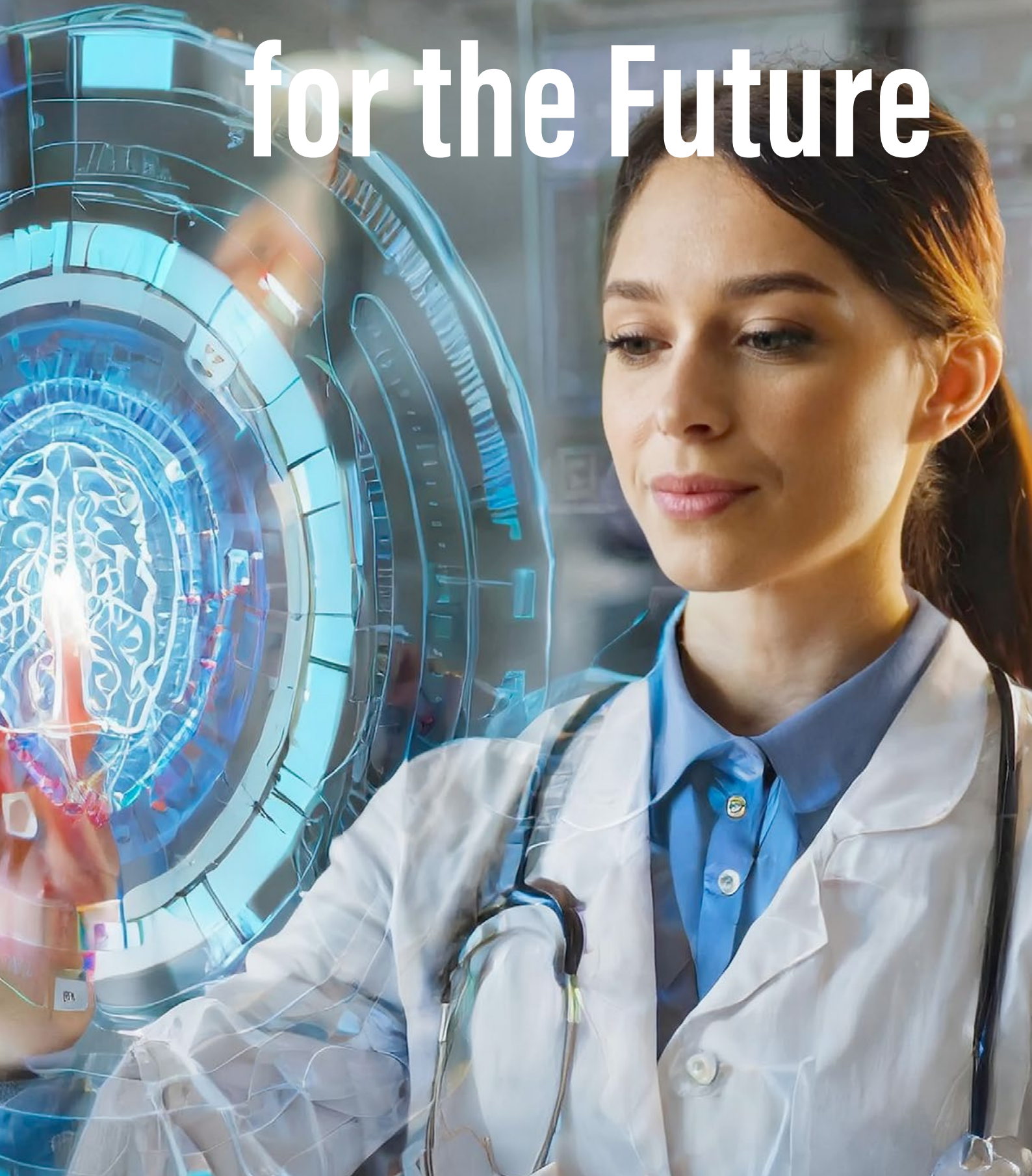
For all these reasons, I congratulate EDIH DigiCare on the report and hope everyone enjoys reading it as much as I did.

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1

A Change for the Future



Digitalization can make a significant contribution to improving patient care.

Digitalization in healthcare, also known as “digital health”¹, refers to the use of information to support the can help patients monitor their symptoms and share their health data with their healthcare professionals in real time. This can allow for and communication technologies prevention, diagnosis, therapy, monitoring and management of health-related issues.

Digital health also includes promoting healthy lifestyle habits.² In recent years, digitalization has permeated almost all areas of life, and healthcare³ is no exception.

The integration of digital technologies into healthcare is not just a passing trend, but an absolute necessity in order to meet the growing requirements for quality, efficiency and accessibility of medical care. Terms such as digitalization in healthcare, e-health, telemedicine, data analytics and big data symbolize a revolution in the healthcare sector. Secure data exchange and an efficient IT infrastructure enable medical healthcare staff, hospitals, manufacturing companies and patients to reorganize the healthcare system. The accelerated exchange, and the creation of patient data networks and accessibility of patient data opens up innovative therapeutic approaches.⁴ Digitalization can make a significant contribution to improving patient care. Digital technologies can enable faster and more accurate diagnoses: Telemedicine, for example, already allows patients to have medical consultations from the comfort of their own home – a great advantage for people in

rural or underserved areas. In addition, digital health applications can help patients monitor their symptoms and share their health data with their healthcare professionals in real time. This can allow for personalized and prompt treatment in the future, which can improve patients’ quality of life.

Another key aspect of digitalization in the healthcare sector is increasing efficiency. By automating administrative processes such as appointment scheduling, invoicing and documentation, healthcare providers can save valuable time and resources.⁵ On the one hand, this improves the workload of medical facilities, and on the other hand, it reduces waiting times for people requiring treatment – a crucial factor, especially in periods where demand is high, such as during a pandemic. Cost reduction also plays a key role: More efficient processes and improved prevention measures can reduce healthcare costs in the long term. In the EU, Germany has the highest per capita healthcare expenditure on average⁶, but healthcare spending is also rising in many other countries. Cost reduction is therefore a highly relevant issue. Digitalization also gives healthcare staff improved access to their patients’ health information. The electronic patient record (ePA)⁷ and, in the future, the “ePA for all” will provide a central platform for storing all relevant medical data. This improves the coordination of care, as all professionals involved are able to access up-to-date information.

This minimizes the risk of mistakes and increases the quality of treatment. Medical professionals also benefit from comprehensive data analyses that help them to make informed decisions more quickly. An improved and transparent exchange of information can also have a positive impact on the relationship between healthcare staff and patients.⁸

Digitalization also opens up new perspectives for research and data analysis: Collecting and analyzing large amounts of data allows for the identification of patterns and trends in disease progression. This can lead to valuable insights into treatment outcomes and prevention strategies. Using artificial intelligence (AI) in diagnostics and therapy development has the potential to advance medical research and produce innovative therapies.

Another advantage of digitalization is increased patient engagement. Digital tools such as health apps and on-line platforms encourage people to actively participate

in their own healthcare. They can monitor their health data, access information about their illnesses and communicate directly with their healthcare professionals. This transparency not only increases awareness and personal responsibility, but also opens up new opportunities for prevention. By having access to personal health data, users better understand how they can prevent diseases. The integration of elements in the form of gamification or bonuses by health insurance companies into these digital tools further motivates people to develop and maintain healthier behaviors. By receiving quick feedback on what does and does not promote their health, they are more willing to actively work on their health and make informed decisions. This ultimately leads to better healthcare decisions and an overall higher quality of life.⁹ Given the challenges the healthcare system is facing, digital transformation is not only desirable, but essential to ensure a future-proof and patient-centered healthcare.





1.1 The Need to Rethink and Adapt

The healthcare system is facing numerous challenges, including demographic change with an increase in multi-morbid patients, a shortage of skilled workers and structural problems such as the digitalization backlog and the insufficient availability of national healthcare data. Comprehensive digitalization could help to overcome these challenges. For this reason, the topic of digital health is becoming increasingly important.¹⁰

Demographic change not only poses a significant challenge to the healthcare sector, it also acts as a catalyst for digitalization. In addition to this change, technological advances and patients' growing need for healthcare also play a decisive role. In addition, the shortage of skilled labor could lead to serious supply bottlenecks:

According to a study by PwC, it is expected that around 1.8 million positions could remain unfilled until 2035. This would increase the current supply bottleneck from 7% to an alarming 35%¹¹. While medical staff complain about the slow pace of digitalization and the associated challenges in their day-to-day work, they often lack the necessary technical know-how to use digital solutions effectively. At the same time, IT specialists often lack the necessary medical expertise and have too little insight into everyday medical practice to be able to assess where and how digital solutions can be used sensibly and which specific requirements need to be met. An interdisciplinary exchange is therefore an essential prerequisite for the successful digitalization of the healthcare system.



Digitalization in the healthcare sector is not only a response to current challenges, but also a proactive strategy to develop future-proof solutions for high-quality and efficient healthcare.

Unfortunately, there has been a lack of quality-assured medical data in Germany to date, although current legislative projects such as the Health Data Use Act (GDNG) aim to bring about improvements. There are also inequalities and discrimination in healthcare that are associated with various factors such as gender, age, education or ethnic background. These inequalities can be observed in the gender data gap, among other things, and sometimes lead to serious disadvantages for those affected. In particular, data sets and survey procedures in medicine either lack medical information on women and non-binary people, or they are severely underrepresented.

Another aspect is the digital backlog: The lack of nationwide initiatives to promote a digital healthcare system and federalism in Germany have led to decentralized, isolated solutions. Structural barriers such as data protection and data security requirements as well as a low level of acceptance on the part of healthcare providers make digitalization even more difficult. Exchanging analog fax messages and filling out paper forms are also still common practices in the German healthcare system, which increases both the use of resources and the risk of information loss.¹²

Demographic change makes digital transformation necessary: As a result of the aging population, the prevalence of chronic diseases is on the rise. This requires more efficient and innovative approaches to patient

care. Digital technologies offer promising solutions for improving the quality of care while reducing costs at the same time. Technological developments in areas such as telemedicine, AI and big data make it possible to develop personalized treatment approaches and increase the efficiency of healthcare processes. These technologies contribute to making faster and more accurate diagnoses as well as customizing treatment plans.

Patient behavior is changing: Today's generation expects more transparency and participation in decision-making when it comes to their healthcare. Digital solutions enable people to actively participate in their health management, quickly access information and talk to experts.

The motivation for digital transformation in the healthcare sector therefore lies not only in the need to overcome existing challenges, but also in the opportunity to break new ground to improve healthcare. This development requires us to rethink and adapt in order to meet changing demands. The aim of this transformation is to create an integrated healthcare system that takes into account both the needs of patients and the requirements of healthcare providers.

Digitalization in the healthcare sector is not only a response to current challenges, but also a proactive strategy to develop sustainable solutions for high-quality and efficient healthcare.



1.2 A Roadmap to the Digitalization Jungle

As part of the “Digital Europe” program, the “European Digital Innovation Hub (EDIH) – DigiCare” project acts as a crucial roadmap to the complex digitalization jungle, especially for small and medium-sized enterprises (SMEs) and healthcare providers. In cooperation with Bayern Innovativ GmbH and Medical Valley EMN e. V., the consortium, supported by the European Commission, is pursuing the goal of providing these players with comprehensive support throughout their digital transformation.

A central element of this project is the Trend Radar, which analyzes the current status of digitalization in healthcare in Germany. It not only shows where there is

potential for development, but also offers perspectives and outlooks that can serve as a guideline for future steps. This makes the Trend Radar an indispensable tool that provides orientation in the often-confusing market and helps decision-makers to find their way through the digitalization jungle. We also publish the Trend Radar as a “trend report,” which provides interested parties with guidance in market observation.

The Trend Radar is a valuable tool for identifying and analyzing trends in the healthcare sector. By systematically monitoring developments in technology, patient behavior and market conditions, decisionmakers can identify relevant trends at an early stage.



This enables them to take proactive measures and fully tap into the benefits of digitalization.

By tracking relevant innovations and assessing their potential impact on the healthcare system, the Trend Radar provides a basis for informed decision-making and strategic planning. In this way, existing challenges can be better overcome and at the same time opportunities can be seized to develop new services or business models. Overall, the Trend Radar helps to make the healthcare system fit for the future and to ensure that technological progress is utilized to the full.

1.3 Digital Solutions as KeyElements

In addition to outpatient and inpatient medical and nursing care providers, highly innovative pharmaceutical and medical technology companies play a decisive role in the healthcare sector. Nevertheless, surveys on the degree of digitalization have found that the healthcare sector's results are regularly inadequate: Compared to other sectors and with respect to the healthcare sector in other European countries, development in Germany is rather sluggish. The reasons cited for this include the regulations in a federal structure (i.e. the individual federal states) and the pronounced specialization and segmentation of care in the corporatist organization of the German healthcare system. As a result, opportuni-

ties to strengthen high-quality healthcare, to increase the effectiveness and efficiency of services provided, and to develop innovative products and services remain partially unseized.¹³

Digitalization in the healthcare system is of crucial importance, as it not only improves the efficiency and quality of healthcare, but also opens up new possibilities for the prevention, diagnosis and treatment of diseases. The digital transformation is particularly relevant for Bavaria, which comprises both rural regions and dynamic urban centers. At a time when the population is aging and chronic diseases are on the rise, it is essential that innovative solutions to meet increasing demand are found. The Bavarian government recognizes that excellent medical care must be available to all citizens – regardless of whether they live in urban centers or rural areas. Digital technologies offer a valuable opportunity in this regard: They enable personalized medicine that is tailored to individual needs and at the same time promote better communication between patients and their healthcare providers. The use of digital solutions can significantly improve medical care in rural regions. Telemedicine and digital health applications can also give people in remote areas access to specialized treatments and consultations. This not only promotes equal opportunities in healthcare, but also helps to improve the quality of life of the population as a whole.

2



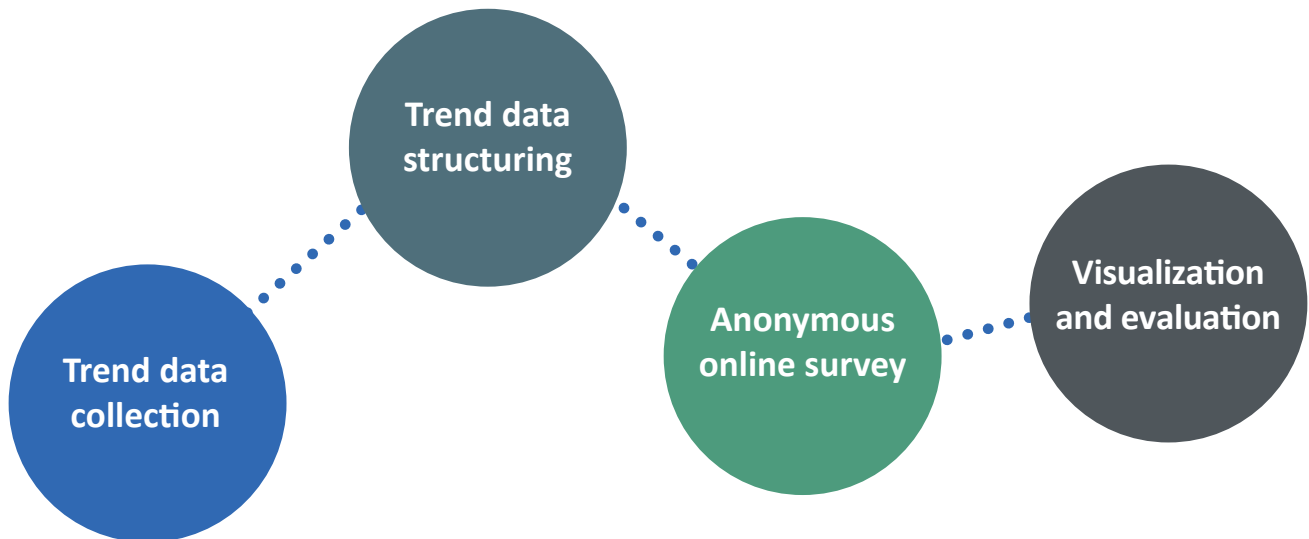
Methodology

Steps Toward

a Roadmap



With methodological support from the innovation management team at Bayern Innovativ GmbH, the Trend Radar was implemented in four steps:



These steps and their underlying processes are described in more detail below..

2.1 Trend Data Collection

In order to gain an overview of the healthcare landscape and its future direction, there was an initial process by which various sources and specialist articles were sifted through. The insights gained were analyzed for trends in digital healthcare, allowing the collection of trend data to begin. The secondary research process began on February 26, 2024 and ran continuously until trend data collection was completed.

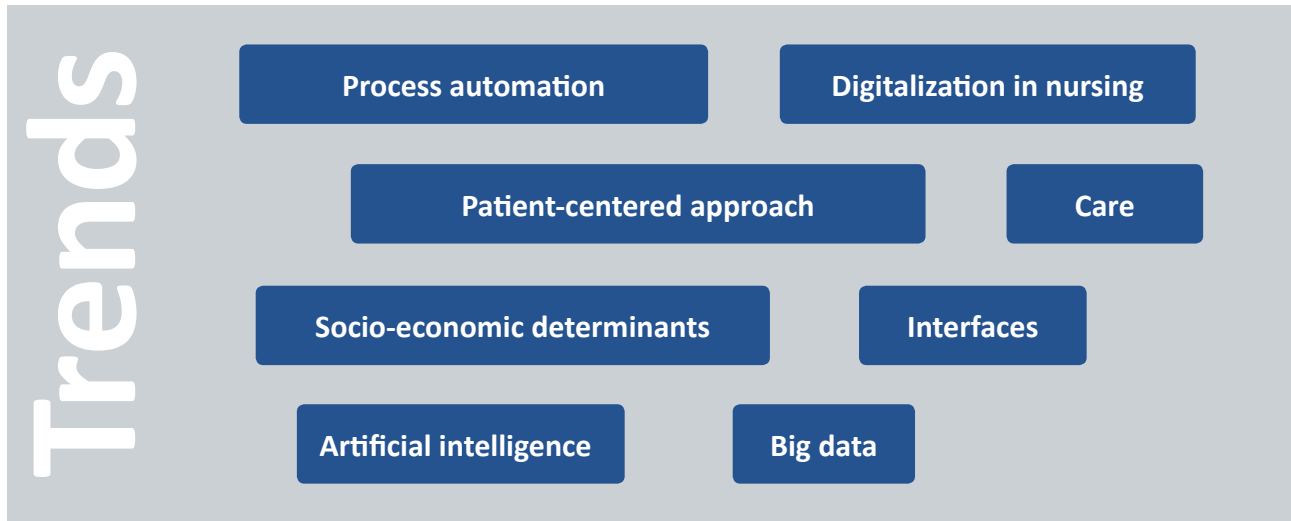
In order to expand this trend data collection with impressions and experiences from the business and science network, the next step was for the Health Division

to scout for trends at various networking events. Various stakeholder groups were specifically involved in this step. This process ran from March 18, 2024 to May 6, 2024. Before starting the primary research, the team analyzed the findings from the secondary research and structured the input in order to be able to collect trend data at the events in a goal-oriented manner. Trend data was collected verbally through informal conversations, in writing using forms at the networking events (e.g. a survey to be filled out on paper or a digital survey) and by sending participants a survey after the event. This broad spectrum of participation formats was used to verify and expand the initial collection of trend data from stakeholders in the healthcare sector.

2.2 Trend Data Structuring

In the next step, the resulting trend data collected from primary and secondary research was structured based on target group and topic and subsequently consoli-

dated. For this purpose, trends were grouped into the following categories, with the categorization resulting from the trend data:



Following additional internal validation in the Health Division at Bayern Innovativ, a total of 40 trends rele-

vant to digital healthcare were discussed in the individual categories.

2.3 Anonymous Online Survey

This structured collection of 40 trends in 8 categories was then evaluated externally by experts. This way, the Trend Radar not only includes the content component of the trend data collection, but also the qualitative

component of expert opinions on these trends. Using an online survey, the trends were categorized based on four evaluation criteria:



In order to better understand the diversity of the healthcare sector and its opportunities, this survey was not

only conducted in general, but also with a specific focus on different target groups and trends.

The wide variety of stakeholders in the healthcare ecosystem was divided into the following perspectives:

Manufacturing companies



Healthcare-providers



(medical professionals, hospitals, therapists, etc.)

Science & Research

(universities/colleges)



Nursing

(outpatient/inpatient)



Stakeholder

The classification into the corresponding categories was based on a self-assessment by the participants in the form of asking about their perspective at the beginning of the online survey. Participants who indicated “Other” and wrote a corresponding description were subsequently assigned to the target groups where appropriate. The online survey was sent to professionals in the respective target groups after it was created and com-

pleted over a period of six weeks starting from July 1, 2024. Participants were recruited both through targeted letters via the Bayern Innovativ email network distribution list and through a public posting of the survey on LinkedIn by Bayern Innovativ’s Health Division. A total of 115 participants were recruited for the evaluation of the 40 trends.

2.4 Visualization and Evaluation

The results were evaluated after the online survey ended on August 16, 2024. The results were visualized using Bayern Innovativ’s Digital Innovation Platform (DIP). In addition, the top trends for each stakeholder group were analyzed in Excel. Finally, the Trend Radars of the stakeholder groups were analyzed with individual

experts from the respective group. The analysis therefore not only includes the opinions of the stakeholder groups, but also voices from these groups on the overall results in the form of nine expert interviews. These results and analyses are explained in more detail in the third and fourth chapters.

3



Digitalization in Healthcare and Underlying Factors

Personal health information is sensitive data.

The following section begins with an assessment of trends across the entire healthcare ecosystem. Digitalization in healthcare is outlined in more detail, and the overall evaluation of the Trend Radar with expert interviews is examined in the next step.

The digital health sector is characterized by a high level of innovation and a wide range of possible applications. The growing potential of digital health is closely linked to technological progress in data collection and analysis, particularly through big data and AI. The increasing use of digital medical devices such as blood glucose sensors, digital health applications (DiGAs) and wearables for health monitoring plays a decisive role.

Personal health information is sensitive data. Comprehensive data protection and clearly defined ownership rights to this data are therefore of central importance. It is important to minimize risks in order to protect the population from data misuse and ensure maximum privacy. High data quality and reliable AI systems are fundamental to avoiding incorrect and potentially dangerous decisions. Studies show that existing societal and social inequalities can persist or even be exacerbated in the digital space. Marginalized groups (e.g. people with disabilities, immigrants, people with low income, and religious minorities) must therefore be fully taken into account when developing and providing digital health solutions in order to avoid discrimination and promote equality.¹⁴

Digitalization in healthcare encompasses the process of integrating digital technologies and solutions into all aspects of medical care and healthcare management. This includes the use of information and communication technologies to improve the efficiency, quality and accessibility of healthcare services. New laws such as the Digital Act (DigiG)¹⁵ and the Health Data Use Act (GDNG)¹⁶ as well as the Federal Ministry of Health's digitalization strategy¹⁷ also have an impact here.

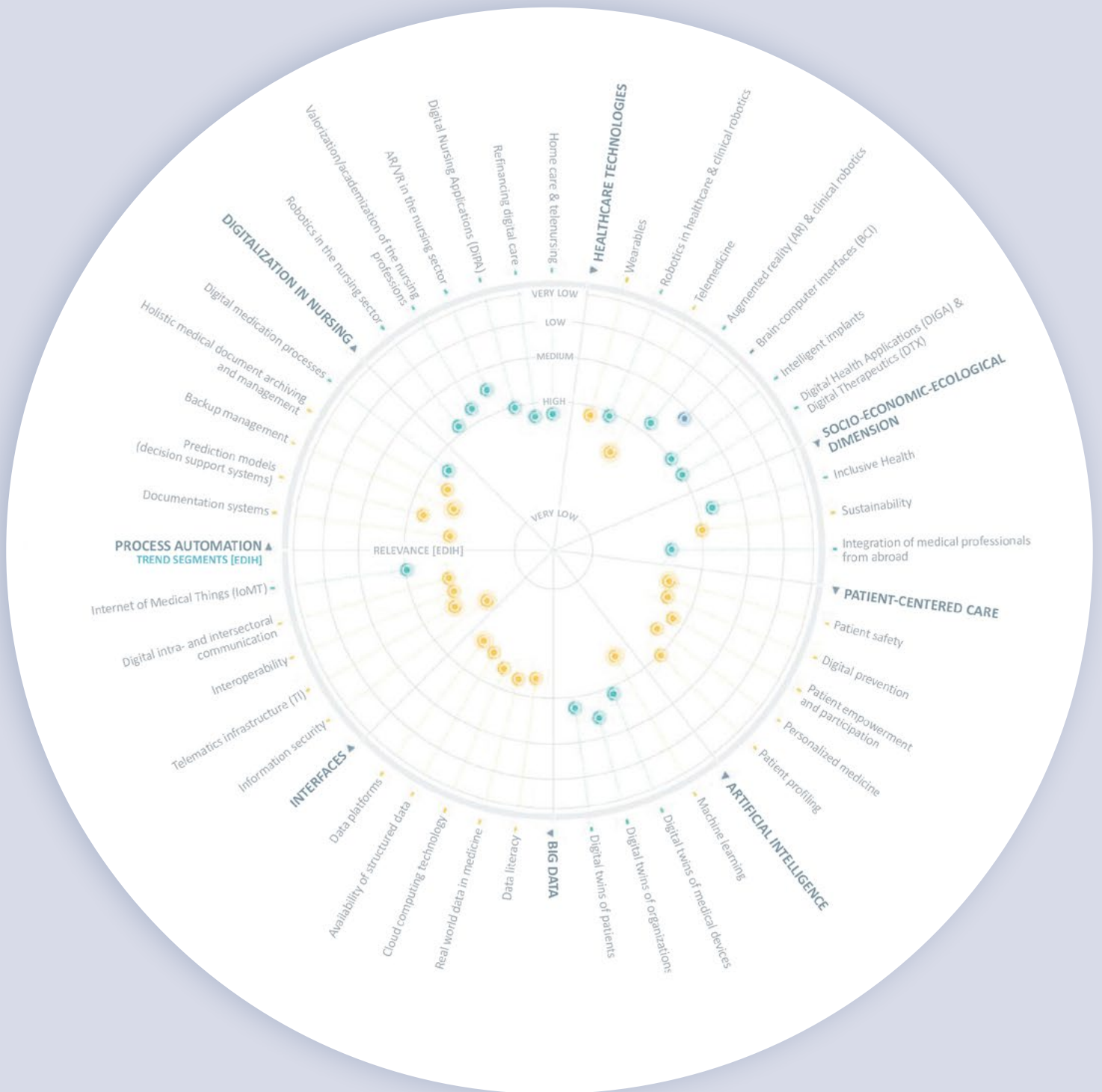
Central elements of digitalization in healthcare are, for example:

- **Electronic Patient Records (ePA):** "As a core element of the Digital Act, the ePA will be made available to all people with statutory health insurance starting from 2025. It will drive forward the exchange and utilization of healthcare data and provide targeted support for healthcare — initially by introducing a digitally supported medication process. Anyone who does not wish to use the ePA can object to this (opt-out)."¹⁸
- **Telematics Infrastructure (TI):** "This is intended to enable the creation of secure medical care provider networks within Germany. Connecting all practices and hospitals ensures that medical documents can be sent to medical professionals quickly and easily, but above all securely. The goal is to avoid multiple examinations and make the healthcare system more efficient."¹⁹

Further elements of digitalization in healthcare can be looked up in a specialist encyclopedia with definitions and sources. Overall, digitalization in the healthcare sector aims to optimize healthcare, simplify admin-

istrative processes, improve collaboration between healthcare providers and manage patients' healthcare data securely and efficiently.

Trend Radar Overview





The relevance of digitalization for healthcare is also evident in the overall evaluation of the Trend Radar. Information security is a top priority. This is followed by patient safety. However, telemedicine, backup management and machine learning are also seen as a priority. In the above-mentioned trends, the level of expertise in Germany is considered to be very high, but the penetration rate is between three and six years. In the case of machine learning, this figure can range from six to ten years. The final implementation of the

trends will still take time, even if a lot of knowledge is already available.

The trends from chapter 2.2 originate from various areas of digitalization in healthcare. This shows how important digitalization is for healthcare as a whole and that it encompasses the entire healthcare ecosystem. Trend Radar overview illustrated in the figure below provides insight into the other elements and their importance in the overall context.

Specialist encyclopedia
and online version can
be found here!



4

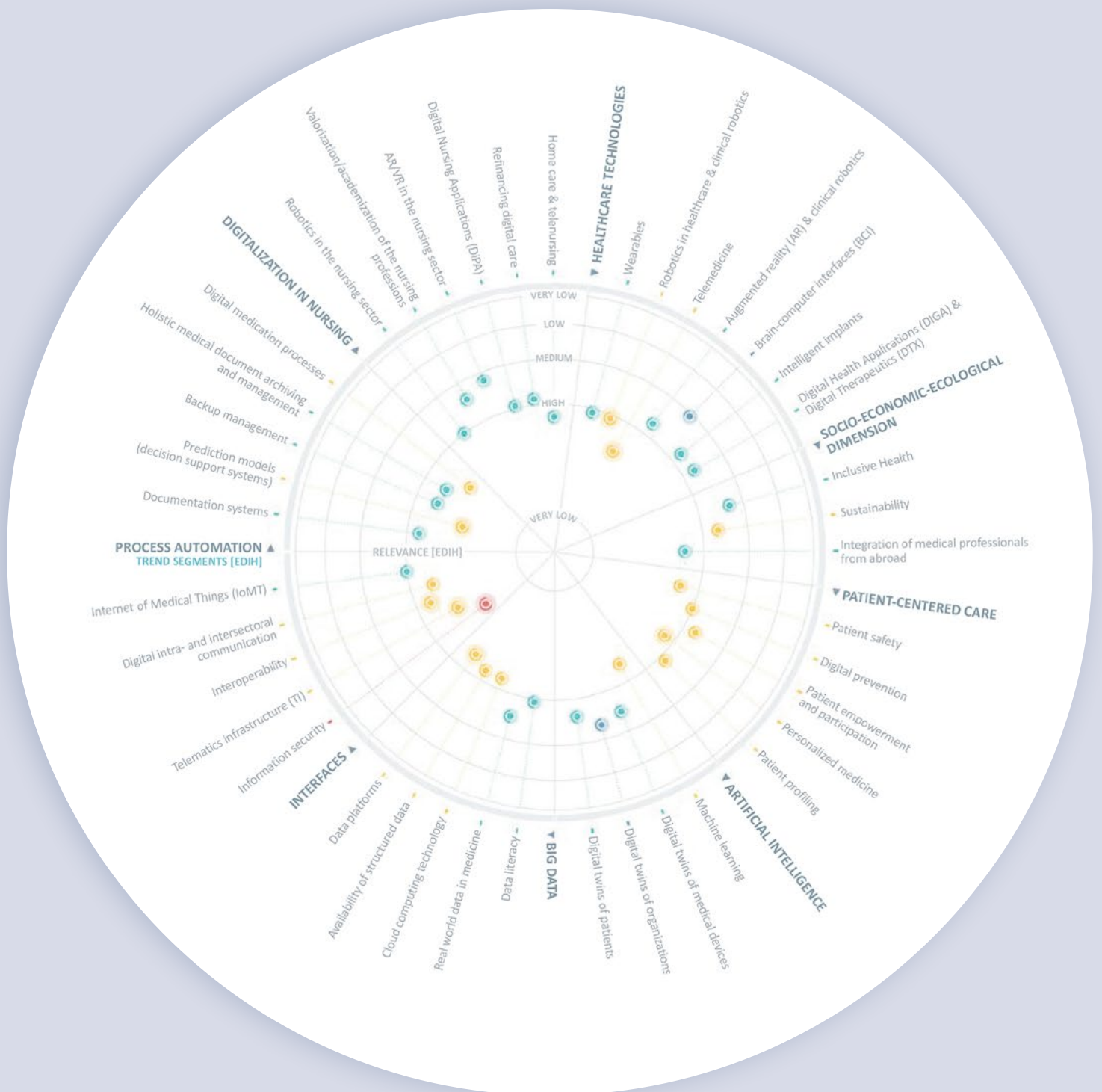
The Target Groups: A Closer Look



In the following sections, the results for the target groups of healthcare providers, medical technology/device manufacturers, universities/colleges (public/state research & institutions and nursing (outpatient/

inpatient) are presented in the diagrams below. There is also an excursus that looks more closely at the population.

Trend Radar Healthcare Providers



4.1 Healthcare Providers²⁰

Telemedicine is expected to play a key role in healthcare in the coming years. Technological innovations such as video consultations could help to shift a lot of data collection to the domestic sector. Interdisciplinary telemedicine teams will become increasingly important in jointly addressing technical and clinical issues. AI-supported systems could continuously analyze vital data and thus indicate the urgency of medical consultations. With the rise in telemedicine services, the requirements for the protection of sensitive patient data and information security in general have also increased. In this context, all stakeholders are faced with the challenge of taking advantage of the opportunities of digitalization and securing their position for the future without losing sight of the potential risks, particularly in the area of data protection and data security. Inadequate technologies can create barriers to the exchange of information and jeopardize patients' trust.

Initiatives such as the Medical Informatics Initiative and the Health Data Use Act also set important standards by promoting the standardization and scientific use of health data. However, there is often a lack of standardized implementation in clinics and practices, which makes it difficult to use data comprehensively across locations. The need for digitalization becomes particularly clear when you consider that the amount of documentation required of doctors has increased in order to improve the quality of care and ensure a continuously high level of patient care. This documentation requirements leave less time for direct contact with patients. A lot of time is currently being lost to analog processes. A key concern is therefore to gain more time for patient care by using digital solutions. In her statement, Prof. Dr. med., Dipl.-Psych. Mirjam N. Landgraf (Doctor of medicine and licensed psychologist), emphasizes the growing importance of telemedicine services:



“Telemedicine services are becoming increasingly important in order to be able to provide patients with care in the most comprehensive and timely way possible. However, employees are often overwhelmed by the introduction of telemedicine as they are unfamiliar with these services and have to familiarize themselves with them. They also worry that this will reduce the quality of their care, as they will have less “hands on” time with patients. Telemedicine services should therefore be established in a way that complements existing healthcare — but they should not completely replace personal contact between doctor and patient, not even for cost reasons.”

Prof. Dr. med. Dipl.-Psych. Mirjam N. Landgraf

*Pediatrician Specializing in Neuropediatrics,
Qualified Psychologist, Certified Child
Protection Physician*



Specialist staff in the outpatient sector is highly motivated to further develop telemedicine. This could not only improve care, but also help to attract more people to these professions and retain them in the long term. The situation is different in the inpatient sector, where specialist staff is currently inadequately trained for current digital trends. It takes a lot of time and effort to familiarize yourself with new systems, especially for people who are not digital natives.

Digitalization is not an end in itself, but it plays a decisive role in improving the quality of care and is therefore of central importance for the future of outpatient healthcare. In this area in particular, healthcare availability is becoming increasingly jeopardized as more and more patients have to be cared for by a limited number of

medical practices. In addition, medical staff are overworked and do not have enough time or resources to cater to patients' individual needs. Crisis situations, such as acute health problems or psychological stress in affected families, often cannot be dealt with appropriately. It is therefore essential to continue working toward digital solutions in order to relieve the burden on staff and optimize patient care. Digital solutions, such as telemedicine or digital patient records, can help to facilitate access to medical care and improve communication between patients and healthcare providers. This makes it possible to recognize crisis situations more quickly and offer appropriate assistance. Digital tools can also relieve the burden on staff by automating administrative tasks, thus leaving more time for direct patient care.

In Germany, there is significant inequality when it comes to access to healthcare services, which can be seen in different regions and social classes. Numerous surveys from various German federal states as well as international studies show that many families have difficulties in obtaining the medical assistance they need. These challenges are exacerbated by the legal framework, which makes scheduling appointments and access to specialists or therapies more complicated. Even during the COVID-19 pandemic, health insurance companies' willingness to support digital health services was limited; although video appointments were permitted, they were often remunerated at a lower rate than face-to-face visits.

Sami Gaber, practicing primary care physician, CMO & co-founder of docport GmbH, predicts that large language models and AI will be increasingly integrated into everyday medical practice over the next 5 to 10 years. These technologies will be able to provide information on drug interactions, complications and undiagnosed diseases during patient care and act as a co-pilot to transform the way doctors work. The recording of health data is also facilitated by patients via wearables and apps. This makes it possible to transmit this data to practices in a structured way. AI systems can pre-analyze this data in order to specifically identify patients who need support. Digital tools, supported by AI, improve data analysis and enable more efficient treatment planning and better patient monitoring. The electronic patient record plays a central role in this regard and offers considerable benefits:



“The electronic patient record, which will be introduced into medical care at the beginning of next year, is a significant step in this direction. The main advantage is that the record will be filled in by all physicians involved in the patient’s care, thus creating a comprehensive information base. More information means more certainty, as all relevant data is available centrally in order to make informed decisions and coordinate care optimally”

Sami Gaber

Practicing Primary Care Physician,
CMO & Co-Founder docport GmbH

Trend Radar Manufacturing Companies



4.2 Manufacturing Companies

Manufacturing companies in the healthcare sector, in particular medical device manufacturers and medical technology companies, are characterized by their innovative strength. In Germany, these predominantly small and medium-sized enterprises invest an above-average amount of money in research and development in order to regularly launch new products and technologies on the market. Their success is therefore based on innovation-friendly framework conditions, public funding and close cooperation with scientific institutions. This enables them to develop technological solutions that put them ahead internationally and secure their competitive edge on the global market.²¹

According to the Trend Radar and the survey on which it is based, six subject areas are at the heart of the digitalization prospects in this sector: Information security, data platforms, back-up management, interoperability, telemedicine and patient safety. These trends not only reflect the technical and regulatory requirements of the manufacturing companies, but also the need to promote patientcentered and resource-efficient healthcare models. Dr. Franz Pfister, CEO of deepc, emphasizes that:



“Digitalization is the key to the transformation of healthcare and central to our work at deepc. It not only enables more efficient processes, but also more precise diagnostics and personalized therapies.”²²

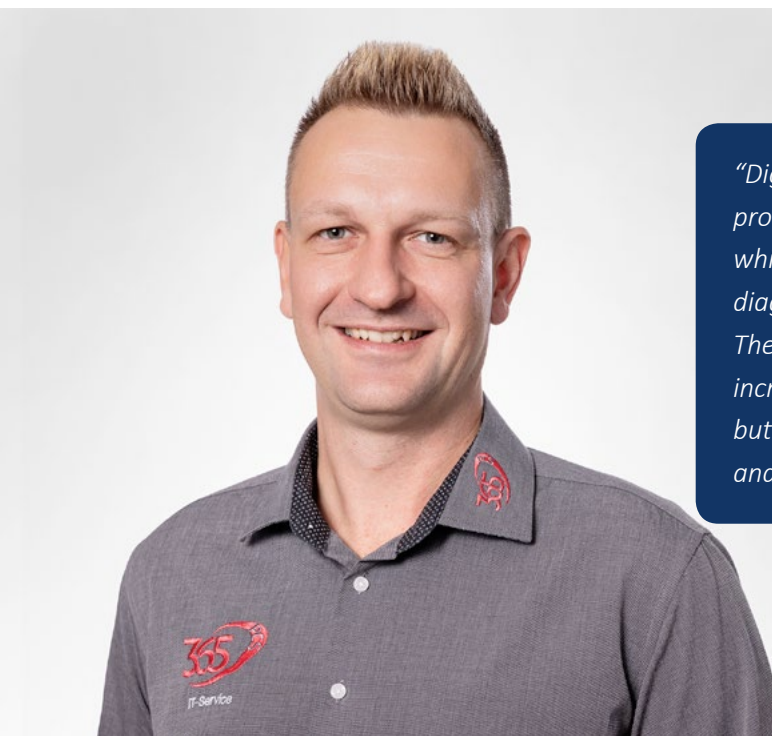
Dr. Franz Pfister

Physician, Data Scientist and
Managing Director of deepc GmbH

With increasing digitalization, the importance of information security is also growing. In the target group of manufacturing companies, information security was assigned both the highest relevance and the highest priority for digitalization in healthcare. In this context, Dr. Franz Pfister (deepc GmbH) points out that “Information security and the development of robust data platforms are cornerstones of our work. The protection of sensitive patient data and user trust are our top priority.”²³ Nevertheless, other developments go hand in hand with this trend. Thomas Ludwig,

managing director of PC-SPEZIALIST Nürnberg and PCS365.de, predicts tighter regulations in the future and expects an increased implementation of security solutions such as blockchain technologies. Information security is therefore one of the key challenges for manufacturing companies in the digitalization of healthcare.²⁴

However, digitalization and the integration of AI also offer enormous economic opportunities. Thomas Ludwig (PC-SPEZIALIST Nürnberg and PCS365.de) explains:



“Digitalization enables more efficient processes and better availability of data, while artificial intelligence helps to improve diagnoses and the patient experience. These developments could not only increase efficiency in the healthcare sector, but also give rise to new business models and innovative products.”²⁵

Thomas Ludwig

Managing Director of PC-SPEZIALIST Nürnberg and PCS365.de

In addition, technologies such as wearables and mobile health applications promote proactive healthcare and strengthen the telemedicine trend.²⁶

Another key trend is interoperability, which enables the interworking of different IT systems. Companies such as deepc with its deepcOS® platform are setting standards in this regard by ensuring the safe integration of AI solutions into existing clinical workflows. The use of such platforms not only improves efficiency, but also helps to optimize clinical results and reduce costs

in the long term. For Thomas Ludwig, “interoperable systems enable a holistic view of the patient’s history and facilitate coordinated healthcare. However, clear standards and cooperation between providers and regulatory authorities are required to continue developing this trend”.²⁷ In the target group-specific Trend Radar, interoperability is therefore one of the top 3 priorities for manufacturing companies.

Sami Gaber, practicing primary care physician and founder of docport GmbH, also sees interoperability as a key trend that can advance digitalization:

“Increased interoperability of healthcare systems is crucial for improving patient care and efficiency in the healthcare sector. The ability to share data seamlessly between different platforms and stakeholders enables a holistic view of the patient’s history and facilitates coordinated healthcare.”²⁸

Sami Gaber

Practicing Primary Care Physician,
CMO & Co-Founder docport GmbH



In Germany, there are high security standards. Nevertheless, there is also potential for improvement in the area of patient safety, particularly through the integration of modern technologies. AI-supported diagnostic systems reduce errors and bolster the high quality of treatment. The expansion of interoperable systems and the standardization of digital processes are crucial to ensuring patient safety in the long term. Dr. Franz Pfister explains that “digital solutions such as AI-supported diagnostic systems [can] help [...] to reduce errors and ensure a high quality of treatment.”²⁹

Despite the potential of digital technologies, in Germany, there are significant hurdles that make comprehensive digitalization difficult. Thomas Ludwig identifies several barriers: “The biggest obstacles to a faster penetration of telemedicine are fragmented legislation, uncertainties regarding data protection and the lack of technical infrastructure in some regions.” There is also a need to catch up in terms of training specialist staff to use these new technologies. An international comparison clearly

shows that countries such as the USA or Scandinavian states take a more proactive stance. In this regard, Dr. Franz Pfister sees a need for action: “The biggest hurdles are regulatory and structural challenges. The lack of interoperable systems, complex data protection requirements and reticent acceptance of new technologies often hinder timely implementation.”³⁰

In summary, digitalization in healthcare presents manufacturing companies with opportunities, but also challenges. With the help of new technologies and trends such as AI, interoperability and patient safety in particular, manufacturing companies can foster technological advances throughout the sector and beyond. Wearables and platform solutions such as deepcOS® are also driving innovation. Nevertheless, from the perspective of manufacturing companies, regulatory hurdles, infrastructural weaknesses and qualification gaps must be overcome in order to realize the full potential and ensure that they can keep up with leading international companies.

Trend Radar Science and Research



4.3 Science and Research³¹

Digitalization has already established itself as a significant factor in the healthcare sector at universities and colleges. This can be seen in the accreditation of study programs such as “Digital Health” and “Digital Medicine”.³² It is becoming clear that simply studying business administration or healthcare management is often not enough to meet the challenges of digital change. Digitalization leads to new forms of interaction in diagnostic and treatment processes and to innovative approaches in personalized medicine. Against this backdrop, healthcare institutions are expressing an urgent need for specialist staff who have specific skills and can actively support them in shaping the digital transformation.³³

In the expert interview with PD Dr. rer. nat. Hanna Hübner (assistant professor and doctor of science), the central role that digitalization in healthcare plays for research is made clear:

Digitalization has already made remarkable progress in healthcare, but its full potential remains untapped — especially in international comparison. One crucial area where there is a lot of catching up to do is the use of routine data. Actions such as the Medical Informatics Initiative set important standards in that regard by standardizing healthcare data and making it accessible for scientific purposes. The German Health Data Use Act also provides essential framework conditions to facilitate the use of health data for research. Despite these positive developments, there is often a lack of standardized implementation in hospitals and practices, which makes it difficult to use data comprehensively across locations. On the other hand, digitalization has significantly advanced research, particularly through the use of AI, which makes it possible to efficiently evaluate large and complex data sets and develop dynamic prediction models.



“Digitalization is the key to making healthcare more efficient, more accessible and more personalized. It opens up new possibilities in research, improves patient care and strengthens the role of patients as active stakeholders in their own health. At the same time, it presents us with the challenge of finding a balance between innovation and security. With a clear strategy and the right balance of technical advances and ethical standards, digitalization in healthcare can serve as a lasting benefit for patients, medical staff and science.”

PD Dr. rer. nat. Hanna Hübner

Molecular Physician and Certified Data Protection Officer (TÜV Süd), Gynecological Clinic of the University Hospital Erlangen



“Digitalization has totally advanced research in my field. There is now so much data and there are so many opportunities to make something useful out of it, be it for more complex analyses or new digital solutions for patients. One example: Thanks to machine learning processes, it is now also possible to analyze unstructured data and handwritten notes and make them quantifiable – a few years ago, this was only possible by hand and accordingly, the amount of data that could be processed was small. We can now make statistically sound statements by systematically and automatically analyzing large amounts of data (including qualitative data). This also harbors great potential for healthcare institutions (from hospitals to statutory health insurance companies).”

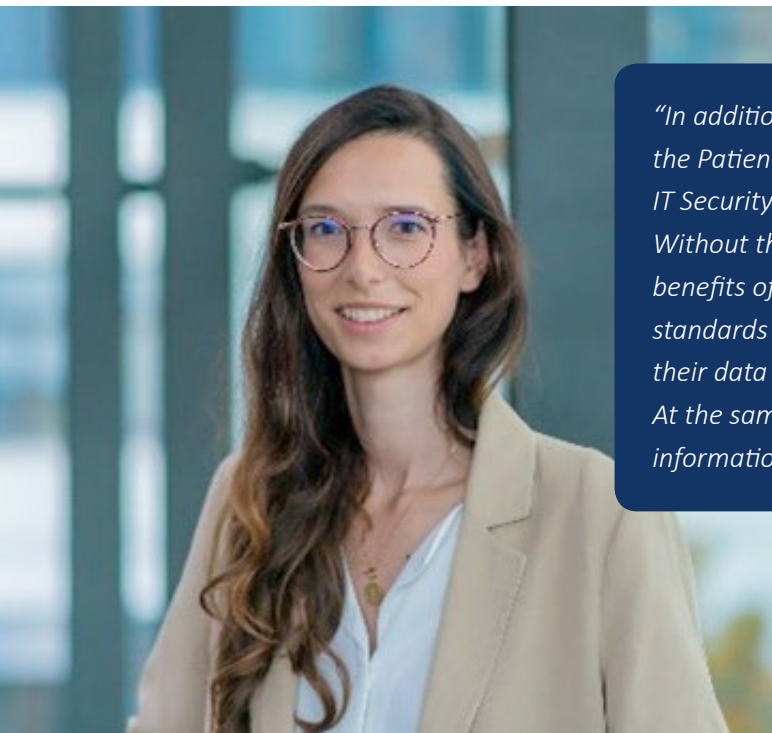
Prof. Dr. Stefanie Scholz

Professor of Data Science in Social Economy and Vice President for Research and Internationalization

Despite innovative machine learning processes, there is still plenty of room for improvement: Access to high-quality data is often restricted, either for legal reasons or due to a lack of interoperability between systems. There are also communication barriers between IT experts, medical professionals and researchers. Greater interdisciplinary cooperation could foster innovative approaches. Further obstacles are the theoretical approaches of many research projects in the field of digital health, which are often not sufficiently linked to practical healthcare. Closer cooperation with healthcare providers should therefore always be considered. In addition, the increasing use of health data requires clear ethical standards to protect patient data and rights.

A number of experts from the research and university sector have identified various key issues and challenges in the field of digital healthcare that will have a significant impact on future developments. Information

security is of pivotal importance. Prof. Dr. Stefanie Scholz points out: “In the next 5 to 10 years, the issue of security will become even more significant.” This is why the concept of “zero trust” is becoming increasingly important: Systems that do not trust blindly, but continuously verify access. The increasing interconnectedness of devices such as smartwatches and intelligent medical technology makes encryption a crucial issue. In this context, AI could play a crucial role by helping to identify vulnerabilities more quickly and prevent potential harm. As digitalization progresses, information security is becoming one of the key concerns in healthcare. According to the General Data Protection Regulation (GDPR), health data is considered particularly worthy of protection, which places high demands on data protection and IT security. Attacks by cybercriminals and the risk of data breaches require robust security concepts to ensure the confidentiality, integrity and availability of data.



“In addition to legal requirements such as the GDPR, the Patient Data Protection Act (PDSG) and the IT Security Act 2.0, patient trust is particularly important. Without this trust, it will be difficult to realize the secondary benefits of clinical data for science. Only the highest safety standards can ensure that patients remain willing to make their data available for research and healthcare. At the same time, their privacy and their rights to informational self-determination must be safeguarded.”

PD Dr. rer. nat. Hanna Hübner

Molecular Physician and Certified Data Protection Officer (TÜV Süd), Gynecological Clinic of the University Hospital Erlangen

It is also important to involve all employees when it comes to information security. Prof. Dr. Stefanie Scholz points out: “The most important thing is to get all employees on board and not just the IT department.” Regular training and clear rules are crucial for creating awareness of security issues. After all, there is great potential in research thanks to digitalization. The ability to systematically analyze large amounts of data opens up new perspectives for innovative solutions in the healthcare sector.

Telemedicine and home care are already a noticeable trend in healthcare. The relevance of these approaches was demonstrated powerfully during the Covid-19 pandemic in particular. The increased involvement of patients in their own healthcare has not only promoted their self-determination, but has also helped to relieve anxieties. This patient empowerment represents a significant step toward patient-centered care and will play an increasingly important role in the future. However, the obstacles to the growth of telemedicine are also a key issue. Prof. Dr. Stefanie Scholz identifies several obstacles: “Legal hurdles” as well as unclear data protection regulations and technical challenges,

such as insufficient internet availability in rural areas, make access to telemedicine services more difficult. In addition, there is often uncertainty about the effectiveness of telemedicine compared to face-to-face consultations in the doctor’s office. The training of specialist staff for digital documentation systems is also viewed critically. Prof. Dr. Scholz points out: “Many doctors and nursing staff often feel left alone with the systems.” To improve the situation, training courses should be organized regularly and with a practical focus on meeting staff needs. In addition, the development of digital skills should be expanded upon during training. In the coming years, telemedicine will play a central role in healthcare. Many forms of data collection that currently take place in hospitals or doctor’s offices could be progressively transformed into tests to be done at home – from simple measurements of blood pressure or weight to complex examinations such as self-ultrasound via tele-guidance or measuring blood levels. The technical possibilities are developing rapidly. At the same time, video consultations, digital communication platforms and automated data exchange systems are becoming indispensable elements of modern telemedical healthcare.

In addition to information security and telemedicine, various key technologies could significantly advance digitalization in the healthcare sector. AI-supported systems enable the automated analysis of complex data and the development of customized healthcare solutions. It is crucial that such systems are validated in clinical trials to ensure rapid implementation in routine care. In addition, advances in sensor technology allow more precise and continuous monitoring of health parameters – even at home. To increase the acceptance of these technologies, data collection should be

seamlessly integrated into everyday life. Central data platforms that provide high-quality and standardized data could also accelerate the development of new prediction models and innovative healthcare approaches.

Digitalization in healthcare not only opens up new opportunities, it also comes with challenges. “With a clear strategy and the right balance of technical advances and ethical standards, digitalization can become a sustainable benefit for patients and medical staff,” concludes PD Dr. rer. nat. Hanna Hübner optimistically.

4.4 Nursing³⁴

The Trend Radar shows that digitalization is also finding its way into outpatient and inpatient nursing and is becoming increasingly important. Michael Wehner, managing director of the Seniorenheim am Saaleufer (retirement home), explains that “progress in digitalization is making many time-consuming processes

in nursing easier.” Digitalization significantly improves the efficiency, quality and safety of patient care. The use of digital technologies enables caregivers and medical staff to exchange information faster and more accurately, which leads to improved communication and coordination in nursing.³⁵



“Digitalization in healthcare is becoming increasingly vital in order to secure the availability of care in all areas. Without digitalization, we cannot cushion the nursing crisis.”

Michael Wehner

Managing Director,
Seniorenheim am Saaleufer GmbH

Digitalization also acts as “process support in day-to-day nursing and is also highly relevant with regard to legal guidelines such as the telematics infrastructure. At the same time, it must be noted that many innovations end up not being introduced into the nursing sector, as the approval requirements often present an enormous challenge for manufacturing companies and healthcare facilities or it is not possible to link them to existing programs/products. Interface problems, IT security-related aspects and data protection issues must be clarified in advance”, Marlene Klemm and Tanja Pollak from Pflegepraxiszentrum Nürnberg (nursing practice center) point out.

Digitalization is also helping to automate administrative tasks. This gives nursing staff more time for direct patient care. Process and documentation automation is notably highlighted in the Trend Radar, as these areas are of particular relevance. The focus is on information security, interoperability and digital intra- and intersectoral communication. For these three core trends, the Trend Radar shows that only average expertise is available in Germany and that the penetration rate for information security is three to six years and six to ten years for the other two core trends.³⁶ There is potential for improvement in this area so that digital systems can be used more frequently for documentation and quality assurance, among other things, in order to continuously improve nursing processes and thus increase patient safety.

The goal should be a “cross-sectoral exchange of informational data,” according to Marlene Klemm and Tanja Pollak (Nursing Practice Center Nuremberg).

Marlene Klemm and Tanja Pollak stress that digital intra- and intersectoral communication lacks a “systematized nomenclature that enables a standardized exchange of data, including evaluation. Agreement on the cross-sectoral use of a comprehensive healthcare terminology such as Snomed CT³⁷ would considerably simplify intra- and intersectoral communication. By creating networks that link different healthcare providers with the help of the telematics infrastructure, it should be possible to exchange relevant patient data more quickly. Comprehensive implementation is currently still lacking, but we very much hope that this will contribute to faster and meaningful intra- and intersectoral communication in the future.”

In summary, digitalization not only bolsters the efficiency of nursing, but also the satisfaction of patients and nursing staff by enabling better care and more time for interpersonal interactions.³⁸ In an increasingly digitalized world, it is therefore essential that the nursing sector integrates these technologies in order to meet the challenges of the future. Mr. Wehner confirms that “sensor technology, for example in fall prevention, falls, position profile and balancing as well as paperless documentation with voice control and much more has made every day work easier and advances in technical developments will increasingly aid in everyday work.”



Marlene Klemm

Management, Nursing Practice Center
Nuremberg



Tanja Pollak

Nursing Specialist and Project
Manager, Nursing Practice
Center Nuremberg

“Digitalization is crucial for the future of nursing. Investments in digital infrastructure and their refinancing are essential in order to realize their potential. Digital skills development programs for nursing staff, family members and care recipients are necessary to ensure high-quality care.”

This is only possible if patient safety, telemedicine and digital prevention are in place. The Trend Radar illustrates this – see the chart. All three trends are categorized in the Trend Radar as having high relevance and priority for nursing, and even as very high for patient safety. The experts rate Germany’s expertise in this area as high. Actual implementation, on the other hand, is still a long way off in some cases – patient safety and telemedicine may take three to six years to implement and digital prevention six to ten years.³⁹

Marlene Klemm and Tanja Pollak point out that patient safety includes, in particular, “emergency concepts that enable access to patient data in the event of a system failure. This is sensitive, personal data that is particularly requires protection. There is often a lack of knowledge in this area among employees, care recipients and their relatives. Information services are therefore needed to explain cases of data misuse and show people how to protect themselves and those in need of care.”

Trend Radar Nursing



In general, the Trend Radar for the target group of nursing shows that a large number of digitalization trends are of great importance and that digitalization is not only on the rise, but has long since found its way into

the market. This is also evident in the extract from the expert interview with Marlene Klemm and Tanja Pollak (Nursing Practice Center Nuremberg):

Marlene Klemm

Management,
Nursing Practice Center Nuremberg



Tanja Pollak

Nursing Specialist
and Project Manager,
Nursing Practice
Center Nuremberg



Is advancing digitalization influencing work in the nursing sector and how do you see this development?

“Digital applications, both in the form of technical products as well as hardware and software solutions, have a significant impact on nursing. However, it should be noted that not every process can or should be digitalized one-to-one. Instead, digitalization should be used as an opportunity to reflect on and redesign existing processes. In practice, however, there is a lack of multipliers or digitalization officers who can develop innovative approaches based on nursing practice. Currently, you often get the impression that nursing is being forced to digitalize its processes. However, there is a lack of health professionals who are able to reorganize the specific processes and adequately prepare and support staff for the digital transformation.”

Could you give examples from your own experience where a particular trend has already had a significant impact?

“Nursing technologies that significantly contribute to saving time, such as electronic nursing documentation by voice input, generate real benefits. The same applies to radar or AI-supported systems for fall prevention or detection or antidecubitus bed systems. This can increase patient safety and reduce transaction costs, e.g. caused by avoidable hospital admissions. Cold plasma applications for the treatment of chronic wounds improve quality of life and reduce pain.”

In the expert interviews, refinancing was emphasized, which is also of significant importance in the Trend Radar. Marlene Klemm and Tanja Pollak highlight that “the sustainable implementation of nursing technologies incurs considerable costs for healthcare providers, both in terms of acquisition and maintenance or in relation to leasing models. However, staff development and the development of digital skills also generate expenditures that must be integrated into the budget and discussed with the nursing care insurance companies in order to avoid an increase in the care recipients’ own contributions.” This is also clarified by Mr. Wehner: “Without refinancing digitalization in the nursing sector, digitalization will not take place, as the politically desired contribution margins are practically zero and therefore do not allow for any entrepreneurial freedom and important investments in the area of digitalization.”

The Trend Radar also indicates a high priority and in fact a very high relevance in the refinancing of digitalization in the care sector in Germany. In contrast, however, the level of expertise is only average and the penetration rate is six to ten years.⁴⁰ This analysis confirms the opinions of the experts.

When analyzing the trends in outpatient and inpatient nursing care, it becomes clear that the penetration rate is very high. This rate is too slow, because after five years, knowledge in this area is considered outdated. DNQP expert standards, for example, are renewed every five years at the latest.⁴¹ With the Nursing Studies Reinforcement Act (PflStudStG) expected to go into effect, the skills for the use of innovative technologies

are to be expanded and incorporated into the curricular structures of the three-year vocational nursing training program.⁴² This ensures that knowledge remains up to date, skills are strengthened and the penetration rate is increased.

Digitalization in the nursing sector has made progress, but there is still a long way to go before digitalization has fully found its way into the nursing sector. In addition, the nursing sector must be more involved in decision-making processes such as the telematics infrastructure. In addition, specialized knowledge on digitalization must be further expanded in the training and further education of nursing staff.

4.5 Population⁴³

Digitalization has been an important part of our everyday lives for many decades. It is therefore not surprising that it is also finding its way into healthcare. This section therefore focuses on the population and patients, and looks at the extent to which digitalization is influencing healthcare and where there is potential for improvement.

Digitalization in healthcare offers numerous benefits for the population, significantly improving the quality and efficiency of medical care. This includes faster and easier access to health information and services. Patients can use digital platforms to book appointments, view their medical records and find information about treatments. This promotes a sense of personal responsibility and commitment to one’s own healthcare.⁴⁴



Birgit Bauer

Project Manager and Founder,
Data Saves Lives Germany

“Digitalization can and will improve healthcare. What’s more, it can no longer be stopped. The first promising solutions are in sight, be it for diagnosis or viewing medical imaging, in research and much more. It is important that people with medical conditions and the general public are well informed and involved in the development of digital paths and developments. Their voices need to be heard. Education, information and dialogue are needed to make digitalization a matter of course.

Our slogan “Health Data – We talk about it!” also applies here. We see opportunities, but we also want to ensure that people with medical conditions in particular make informed decisions about their digital behavior and their health data.”

Health data should go hand in hand with data security. Birgit Bauer, project manager and founder of Data Saves Lives Germany and the European Digital Health Academy edha gGmbH, emphasizes that “sick people often search the internet for answers, consult “Dr. Google” or ask ChatGPT. The problem is that using these tools is difficult, as there is often a lack of necessary knowledge, and in emotionally stressful situations people tend to believe information rather than question it. This thoughtlessly accepted information can lead to decisions that are not always helpful. It must therefore be ensured that health information comes from trustworthy, up-to-date sources. It should be

clear and understandable – from easy-to-understand to academic language. Different formats are needed to reach every person at their level and help them find the right information.”

Educating the population is of great importance, because information is of little use if it is not understood by the citizens. Birgit Bauer is in favor of “more education that is agreed on by experts, comprehensible and trustworthy. Instead of many offers, a central one should be created that is easily accessible, both digitally and analog – older people in particular are often better reached with brochures.”



Birgit Bauer also highlights that more emphasis must be placed on raising awareness of patient safety in order to “make the topic better known and support or discuss relevant measures. People need to know their rights and that there are legal requirements and international standards that should be in place to safeguard their treatment. This strengthens trust and adherence, but also ensures better decisions for patients.” It is also clear that “safer treatments mean less suffering, lower costs and better results – for everyone involved,” says Birgit Bauer.

Digitalization also improves communication between sick people and healthcare providers. Telemedical services enable patients to have medical consultations from the comfort of their own home, which is particularly beneficial for people in rural or underserved areas. This form of care not only reduces travel distances and waiting times, but also facilitates access to specialized medical staff.⁴⁵

Digitalization also helps to improve the quality of treatment. By using electronic health records, healthcare professionals can quickly access comprehensive patient data. This enables informed decision-making and personalized treatment. Analyzing health data can help to identify patterns and develop preventive measures that promote the general health of the population.⁴⁶

Digitalization can increase efficiency in the healthcare sector. Digital systems can automate administrative processes, which reduces the administrative burden and frees up resources that can then be used for direct healthcare. This leads to better utilization of existing capacities and greater satisfaction among both patients and healthcare providers.⁴⁷

According to Birgit Bauer from Data Saves Lives Germany (DSL DE), when it comes to the question of further trends toward digitalization in healthcare:

“People with medical conditions and the general public need more knowledge and education. The trust that is often lacking in political circles must be built up through open dialogue and by involving those affected. It is a challenge, but it is crucial to talk to the ‘end users’ as they are directly affected by the trends and solutions. The trend towards education and information should therefore be utilized. Another trend we are observing at DSL DE is people’s openness. This openness, which encourages curiosity, gives us the opportunity to enter into dialogue and share information.

It is important to utilize this openness together — not with fragmented projects, but with a strong, common voice that is heard. After all, it affects all of us as a society.

Another important trend concerns the complexity of the healthcare system. Processes must be simplified. Artificial intelligence, chatbots and digitalized forms are already making many things much more efficient. Another advance that we are already seeing in some areas is personalized medicine. The more customized treatments we develop, the better we can provide people with targeted care. Especially in the area of women’s health — where it is often unclear whether the dosage of a drug that works for men is also effective for women — we still have a lot of catching up to do. Health data can make a key contribution to providing women with better care in terms of medication, dosage and diagnoses.”



Birgit Bauer

*Project Manager and Founder,
Data Saves Lives Germany*

The digitalization of healthcare is a crucial step towards improving care for the population, facilitating access to healthcare services and improving the quality of medical treatment. It helps to ensure that patients are better informed, are more actively involved in their healthcare and can ultimately lead healthier lives.

5

A hand is shown pointing towards a futuristic digital interface. The interface features glowing blue and orange lines, charts, and data points. A prominent circular graphic contains the number '211'. The background is filled with bokeh light effects in blue and orange.

Future Prospects of the Respective Target Groups and How They Interact

The comprehensive integration of all players in healthcare must be a central goal.

At this point, it is already clear: Digitalization is undoubtedly bringing about a profound change in the healthcare sector. It opens up numerous opportunities for improved and more efficient care, even in regions with poor infrastructure, and promotes the development of innovative treatment options. By linking data intelligently, preventive, diagnostic and therapeutic measures can be optimized.

More and more digital solutions, such as apps, wearables and telemedical approaches, are penetrating the healthcare market. These technologies record, collect and analyze treatment-related data and are becoming increasingly popular with users.⁴⁸

A central goal must be the comprehensive integration of all players in the healthcare system. Because only through integration can information be exchanged more quickly and efficiently between all healthcare providers. This leads to better coordination of treatment plans and reduces misunderstandings. This means that patient care can be organized more holistically and better tailored to their individual requirements. In addition, integrated systems make it possible to avoid redundant processes and optimize the use of resources. This can lead to increased efficiency, cost reductions and faster provision of services. Comprehensive integration enables researchers to collect and analyze health data. This leads to better insights into disease progression and treatment outcomes and drives medical research and the development of new treatment methods. Overall, comprehensive integration helps to improve the quality of healthcare and promote the health of the population in the long term.⁴⁹

New digital solutions that work across all sectors are needed to future-proof healthcare structures. The ePA or the telematics infrastructure already ensure cross-sector integration. This is expected to be expanded further. In the telematics infrastructure in particular, the connection of the care sector and the medical professions must be advanced quickly. By integrating digital solutions, care structures can be made more flexible, efficient and patient-centered, which ultimately leads to better healthcare.⁵⁰

The expansion of telemedicine is of crucial importance for ensuring modern healthcare in urban and rural areas. Comprehensive implementation of telemedicine makes it possible to bring medical services to places where they are difficult to access for many people – be it due to remote locations or limited mobility. Patients do not have to travel such long distances to receive medical assistance. Waiting times are shortened, diagnoses are made more quickly and treatments are started earlier. Telemedicine also reduces the risk of infections, especially during epidemics or pandemics, as patients do not have to sit in overcrowded waiting rooms. The possibility of carrying out consultations from the comfort of your own home therefore contributes to the safety and health of everyone involved. For chronically ill patients, telemedicine makes it easier to integrate regular check-ups and consultations into their everyday lives and significantly improves their quality of life. In this area, innovative technologies such as video consultations and AI-supported systems are expected to fundamentally change the way in which medical services are provided. This not only offers the opportunity to optimize patient care, but also relieves

the daily workload of specialists. The integration of AI technologies will help to continuously analyze vital data and specifically identify patients who need support. This can not only increase the efficiency of treatment planning, but also improve the quality of care. The ePA will play a key role in this by creating a comprehensive information basis and facilitating informed decisions.

The effective utilization of big data has enormous potential for healthcare and research. The increasing volumes of data generated by digitalization create the opportunity to detect diseases and risks earlier and more accurately. At present, much of this valuable data remains unutilized and the exchange between different research locations is limited. It is therefore important to work on expanding access to this data while safeguarding data protection in order to ensure optimal healthcare for the population.

In the age of big data, the highest level of data protection and data security is essential for the success and acceptance of digital integration in the healthcare sector. It remains important that all those involved do not see these aspects as obstacles to digitalization. Rather, they should be seen as an integral part of the responsible handling of sensitive information.⁵¹ The protection of health data requires robust security concepts and clear ethical standards to ensure patient trust. It is also important to involve all employees in the topic of information security and to offer regular training.

In principle, the training and further education of medical and nursing staff should be a high priority. The German Act to Strengthen Nursing Studies (PflStudStG)⁵², which is expected to go into effect, will address the issue in nursing (see section 4.4 Nursing, target group nursing), but this is not enough. By increasing staff training in the use of digital technologies, institutions can help to overcome reservations and fully tap the potential of these innovations. Close collaboration between technology providers and healthcare institutions is necessary in order to develop customized solutions that meet the specific needs of users.

Finally, the topic of digital equal opportunities should not be neglected: It is crucial to ensure that all population groups have access to digital health solutions – regardless of age, education or social status. This is the only way to ensure that everyone benefits from digitalization in the healthcare sector and that no one is left behind.

In the coming years, digitalization will play a transformative role in the healthcare sector, fundamentally changing both the training of specialists and care structures. The introduction of specialized study programs such as “Digital Health” and “Digital Medicine” at universities and colleges is just the beginning of a comprehensive change aimed at meeting the challenges of the digital age. The need for interdisciplinary skills is being recognized increasingly as traditional study programs are often not sufficient in meeting the complex requirements of the digital transformation.

Where the Future is Taking Us

6





All in all, digitalization has the potential to fundamentally transform the healthcare sector – provided we use this opportunity responsibly and sustainably. In summary, it can be said that the legal framework for digitalization in the healthcare sector has been created and the market continues to develop dynamically. In the so-called second healthcare market – “which is generally understood to include over-the-counter drugs and personalized healthcare services, fitness and wellness, health tourism and, to some extent, the areas of sport/leisure, nutrition and living”⁵³ – numerous digital applications are already established, including a large number of health apps and wearable technol-

ogies. These technologies enable users to proactively monitor and manage their health, which can lead to better prevention and early detection of diseases. In contrast, the primary healthcare market is still showing clear signs of an early development phase in terms of digitalization. This opens up considerable growth potential for the healthcare sector.⁵⁴

Germany’s success in taking advantage of the opportunities offered by digitalization in the healthcare sector will largely depend on the extent to which the various players manage to create the conditions for a successful transformation.

The trends are clearly recognizable: The healthcare system of the future will be a cooperative network. This development requires all parties involved to strengthen their ability to cooperate beyond the boundaries of sector and care. Interdisciplinary cooperation between all stakeholders in healthcare is crucial in order to develop integrated care concepts.⁵⁵

Challenges such as a lack of acceptance on the part of healthcare providers, a lack of education and training on digitalization in healthcare – be it product training, adaptation of study programs or employee development, for example – inadequate technical infrastructure, strict guidelines and hurdles in the area of data protection and data security all stand in the way of progress. There is also a lack of incentives and nationwide health initiatives to drive this change forward. Increased funding for pilot projects could help to test innovative approaches and prove their effectiveness.

The integration of digital health into everyday life will only succeed if a seamless connection to the analog world is established. Digital health solutions should be designed in such a way that they are intuitive and user-friendly. Clear language, large fonts and simple navigation can help less techsavvy people to feel confident and recognize the benefits of digital services. It is particularly important that interaction between patients and healthcare professionals continues to take place increasingly in person – but for this to happen, a reduction in the workload of medical staff is urgently needed. Digital tools to support administrative tasks or a better infrastructure could help in this regard, leaving more time for this personal contact.

Furthermore, the low demand for the ePA makes it clear that communication about the benefits of digitalized medicine and digital health must be intensified in order to convince patients of the solutions available to them. Educational campaigns can help to raise awareness of digital services and build trust. However, in order to make the most of the opportunities offered by digitalization and, in particular, to drive progress in

the German healthcare system, it is essential to set specific priorities. The need for action identified in the Trend Radar can serve as a valuable guide.⁵⁶

The German healthcare system is at a crucial turning point where digitalization offers both challenges and significant opportunities to improve the quality of care, efficiency and patient engagement. In order to fully tap this potential and create a sustainable healthcare system, the joint commitment of all stakeholders is essential. Particularly noteworthy is the growing importance of telemedicine, which facilitates access to medical services and optimizes patient care. At the same time, data protection and data security must be given the highest priority in order to guarantee patient trust.

The integration of new technologies such as AI-supported systems and the ePA have the potential to improve the quality of care and reduce the workload of specialist staff. At the same time, it is clear that many employees in the healthcare sector are not yet sufficiently prepared for digital trends, which requires targeted training and support. In order to fully make use of the benefits of digitalization, it is essential to advance digital solutions while maintaining personal contact between doctor and patient.

Ultimately, digitalization is not an end in itself, but a necessary step toward ensuring high-quality healthcare both now and in the future.

- ¹ https://health.ec.europa.eu/ehealth-digital-health-and-care/overview_de
- ² Cf. Volpert, A. *ibid.* (2023): Digitale Gesundheitsversorgung 2033: Trends, Szenarien und Thesen, p. 4.
- ³ Federal Ministry of Health. (2024, July 1). Digitalisierung im Gesundheitswesen. <https://www.bundesgesundheitsministerium.de/themen/digitalisierung/digitalisierung-im-gesundheitswesen.html>
- ⁴ Lux, T. (2017). E-Health – Begriff und Abgrenzung. In: Müller-Mielitz, S., Lux, T. (eds): E-Health-Ökonomie, p. 3-5.
- ⁵ Pang, Z., Yang, G., Khedri, R., & Zhang, Y. T. (2018). Introduction to the special section: convergence of automation technology, biomedical engineering, and health informatics toward the healthcare 4.0. *IEEE Reviews in Biomedical Engineering*, 11, 249-259.
- ⁶ OECD/European Observatory on Health Systems and Policies (2023). State of Health in the EU Deutschland Länderprofil Gesundheit 2023.24d9c14d-ddc9-430d-9571-2c1faf47b79b_en
- ⁷ Federal Ministry of Health. (2024). Die elektronische Patientenakte für alle. <https://www.bundesgesundheitsministerium.de/epa-vorteile/>
- ⁸ Cf. Bauer, Birgit (Data Saves Lives Deutschland, European Digital Health Academy edha gGmbH): Interview: 11/25/25
- ⁹ Mittermaier, M., Sina, C., Richter, J. G., Raspe, M., Stais, P., Vehreschild, J., ... & AG DiGA und KI in Leitlinien der Kommission Digitale Transformation der DGIM. (2022). Praktische Anwendung digitaler Gesundheitsanwendungen (DiGA) in der inneren Medizin. *Der Internist*, 63(3), 245-254.
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