



The Future Patient Room

Meik Eusterholz, Melanie Alessandra Katterbach
and Celina Sander

Introduction and Vision for 2025

Digital transformation is driving companies in the healthcare industry to redesign their entire organizational structure. It also provides patients and hospitals enormous benefits. The term Smart Hospital signifies an organizational shift towards patient-centered facilities in which the use of modern technologies is triggering new processes, automating non-value adding activities, thus improving the quality of outcomes and treatment (Eusterholz 2019).

The patient room alone offers numerous possibilities for value-added patient care in hospitals thanks to the integration of new technologies. From an objective point of view, however, the patient room is a functional room. The patient remains here between examinations, surgical interventions or various other treatments. This room may not be of great importance for medical staff in hospitals. It is a common room and in most cases does not even earn much money for the hospital. However, from the patient's subjective point of view, the lounge-like area is a central place. This is where patients spend most of their time during their inpatient stay. Therefore, devices and amenities have much more influence on the patient than on the doctors, nurses, hospital management and other service providers.

The patient room of the future will be full of innovations and technical highlights. In addition to enabling optimum control in medical care, the furnishings provide the patient and guests with a certain feel-good factor. It is also patient-friendly thanks to its barrier-free design and the fact that it maintains the highest possible hygiene standards. The room is digitally networked with smartphones, laptops, notebooks and telemedical software. This allows for seamless and automated patient monitoring and docu-

mentation. Through networking solutions, the traditional exam room can be shifted to the patient's room—where services are provided directly to the patient since patient data can be retrieved from any location. Lighting and acoustic concepts are also “smart,” facilitating the control of these systems. The patient room of the future can be compared with the standards of an attractive and modern hotel. Service quality is increasingly coming to the forefront so that the focus is on the healing architecture of the room (Leydecker 2017). The patient's emotional and physical well-being is promoted by an attractive design in the single room concept, thus contributing to the overall healing process.

Trends in Healthcare

The State of Technology

When it comes to digitalization on both international and national levels, the German healthcare system is at the bottom of the list. In comparison to other German industries, it is regarded as a digital beginner. In the future, however, it is a fair assumption that the degree of digitalization will increase. Nevertheless, at a mere 20 percent, highly digitalized processes in the healthcare sector are still rare. According to the DIGITAL 2018 economic index, around 32 percent of the companies surveyed stated that they use applications in the “Internet of Things” (IOT) area, but only two percent use “Big Data” applications (BMW 2018).

In hospitals, innovative technologies are used primarily in the field of imaging and other specific, functional areas. Through individual initiatives, more and more innovative solutions are finding their way into the hospital where they provide significant, everyday working life support. These solutions are based on artificial intelligence (AI), clinical decision support systems or intelligently networked solutions such as smart mattresses (Bauer 2019).



A major shortcoming, however, is Germany's inadequate IT infrastructure. The development of a uniform telematics infrastructure (TI) has been going on in Germany for more than 10 years and is hampering the rapid networking of digital processes. With the help of TI, service providers will be networked, making cross-sector communication and the transfer of patient and case data possible (PwC 2014).

Taking a glance at neighboring countries shows how this expansion can function better. Denmark is at the forefront. The state is investing € 5.6 billion to digitalize and network its healthcare system for the future use of state-of-the-art technology. By 2025, 18 ultra-modern super hospitals will be built. In addition, Denmark has been utilizing electronic health records (EHR) for the past 10 years and telemedicine is already a part of everyday life. Track & Trace has also helped to significantly optimize the use of resources through the set up an infrastructure based on the location of all people, objects and devices. This infrastructure enables medical devices such as mobile ultrasound devices to be localized and treatment planning can be adapted based on the availability and location of the device. A bed management system, for exam-

ple, can be used to locate free beds via the infrastructure, organise the cleaning and disinfection, as well as the maintenance processes. Now Denmark is five to ten years ahead of other countries when it comes to innovative health solutions (Conser 2015).

Future Developments in Healthcare and Technology

On average, the healthcare market for digital and innovative technology is growing faster than the overall economy (Sauer and Storz 2018). When new technologies are seamlessly integrated into a system landscape, significant benefits can be achieved for both the hospital and patient. Efficient processes effectively relieve staff and significantly improve the quality of care (Bauer 2019). In the future, five key technology areas will arise in healthcare:

The first is Artificial Intelligence (AI). About one-fourth of all patients believe that a more accurate medical diagnosis can be achieved using AI. The use of big data and AI plays an important role. Both can significantly support physicians in analyzing clinical data and interpreting data from imaging procedures or contribute to optimizing clinical research (vbw 2019).

Second, wearables can be used to monitor multiple parameters such as heart rate, sleep quality, training programs and much more.

The third technology area is virtual reality (VR) and augmented reality (AR). With AR-based apps, surgeons can practice every step of an operation in advance.

The IOT is the fourth area. Although it is not yet represented, networking and the integration of different medical devices in hospitals, databases and patient management software will provide a great deal of valuable data.

Last but not least, various breakthroughs have been made with 3D printing, such as in the treatment of burn victims, tracheal splints, and printing living tissue with blood vessels. Thanks to advancing digitalization, it is now possible to calculate exact 3D models in real time, which in turn simplifies the planning of an operation for the physician (BNP PARIBAS 2018).

Nevertheless, challenges for German hospital managers are, in particular, an additional burden on the organization and employees. Change management requires more attention and plays an important role for sustainable implementation. In addition, high investment costs, as well as the lack of digital expertise and data security by relevant stakeholders, are large obstacles (Berger 2018).

However, many digitalization projects are already failing due to the lack of infrastructure, complicated approval procedures, inadequate reimbursement regulations, and high regulatory requirements. Although responsible politicians and public authorities have an acknowledged willingness to take action, an enormous need to do so still remains (Reinhard 2018).

In addition, the issue of data protection has been raised repeatedly in the context of digitalization. Health data (patient-related or -referable) represent a special type of personal data and must be, therefore, protected. The handling of this data and, above all, its integration into IT systems is linked to high demands and is complex, which is why its usability has been restricted. However, there are already solutions that meet the data protection requirements from an IT perspective (Lux and Breil 2017).

Changes in the Patient Room

Benefits of the Patient Room

Although the multi-bed room concept is predominantly widespread in German hospitals, many clinics are now responding to the high demand for single rooms by offering ‘comfort wards’. The amenities in these rooms differ considerably in comparison to those in normal wards. Hospitals are orienting themselves towards hotel standards in terms of comfort and offering patients’ laundry and ironing services, internet, flat-screen TVs, and a wider selection in terms of meals. However, these luxuries only apply to patients who can pay accordingly. The price per night in a single room is between € 80 and € 150 unless a patient has additional insurance that covers this cost. Access to better rooms and healing is denied to all other patients, especially those with statutory health insurance who cannot afford the service for financial reasons. The standard room for those with statutory health insurance is a multi-bed room (Gurr and Stelter 2016).

X In addition, although many hospitals emphasize that the quality of medical care in single room wards does not differ from that on the multi-bed wards, the single room structure alone is associated with a better recovery process.

It has been scientifically proven that single rooms ought to be used more frequently, especially from a hygienic point of view. Numerous advantages significantly increase patient satisfaction, avoid unnecessary bed blocks for isolated patients and shorten the overall length of stay. Some of these include separate sanitary areas, fewer medication errors, fewer bed transfers, lower risk of infection, greater privacy and data protection, better communication between staff and patient/relatives, less noise and disturbance from a roommate and better quality of sleep (Detsky and Etchells 2008). Years ago, the German Society for Hospital Hygiene argued that single rooms should be the focus of new construction projects. However, this is still not being practiced in Germany, while other countries are already implementing the increased use of single bedrooms. In England, a quota of 50 percent was agreed upon for the use of single rooms. Canada and the US are demanding that only single rooms should be built in new hospitals (Exner and Popp 2011). In Denmark, the advantages of having single rooms have been fully taken into account—their super hospitals are being built on the single room concept.

The Future Goals of Various Stakeholders

The patient room of the future has three main stakeholders:

- the staff
- the management
- the patient and his or her relatives

From these three different perspectives, different requirements (see fig. 1) can be derived in order to fully exploit the potential of the future patient room and to provide maximum satisfaction to each stakeholder.

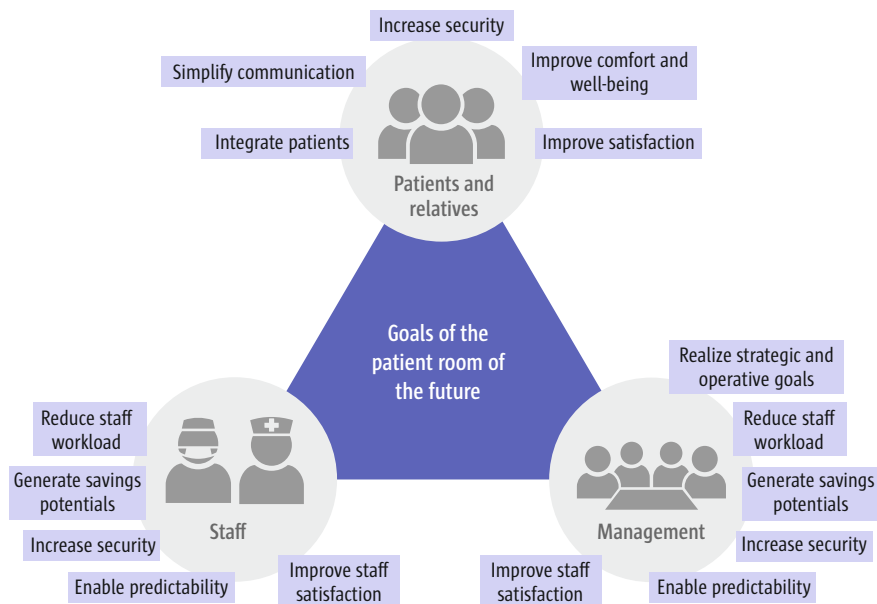


Fig. 1 Goals of the patient room of the future (UNITY AG, for more information: <http://bit.ly/PatientRoom>)

Care processes focus on the patient, who wants to recover fully. From the patient's perspective, requirements are derived which, facilitate communication, improve hygiene standards and safety, increase comfort and well-being with a pleasant atmosphere as well as adequate service offerings. Ultimately, satisfaction should be improved through increased transparency and individualized treatment.

The primary importance for the staff is to be relieved of redundant documentation and administrative activities, as well as gaining a high level of occupational safety. With the help of efficient processes, they wish to eliminate possible sources of error and, for example, anticipate risks by using comprehensive sensor technology in order to have more time available to perform their main duties.

For management, there are requirements, such as the optimal use of resources, that aim to achieve both strategic and operative goals. In addition, maintaining high-quality results and processes is important for management to improve both patient and staff satisfaction. A pleasant working atmosphere and a high level of patient trust promote the recovery process and personnel error rates. In the long term, the following can be achieved through higher efficiency in capacity utilization: savings potentials, reduced lengths of stay and higher occupancy rates.

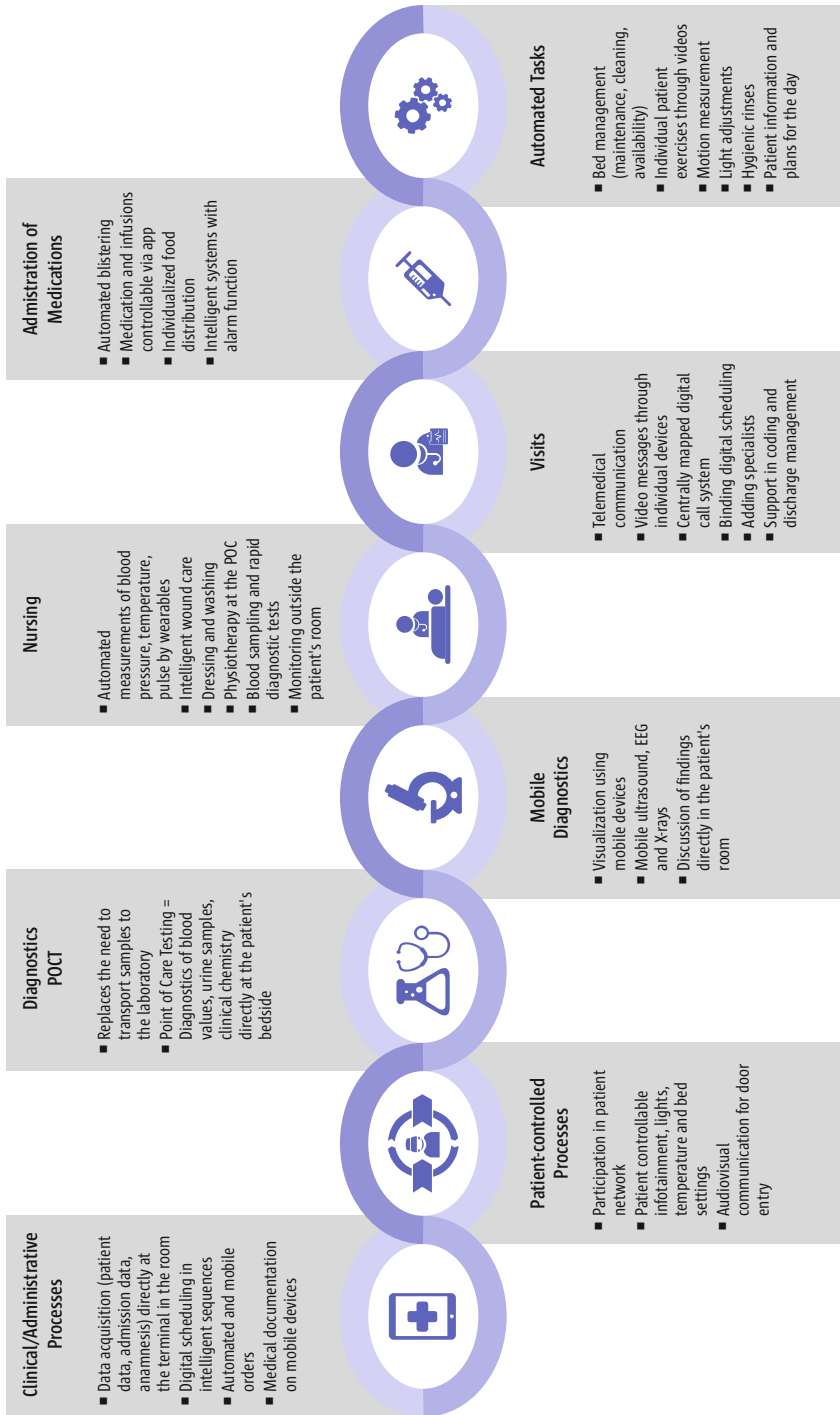


Fig. 2 Processes at the patient room of the future (UNITY AG, for more information: <http://bit.ly/PatientRoom>)

Future Processes

X With the establishment of the single room concept and the technological possibilities it provides, the patient room will play an increasingly important role in the care process of the future.

To ensure that stakeholder objectives can also be met in the patient room, there will be a shift in the provision of services from the traditional examination room to the patient room.

In the future, a large number of processes (see fig. 2) can be carried out directly on the patient's bed from the time of admission. The room will be digitally networked with medical devices, medical software and the patient can control light, infotainment, door or bed settings directly via mobile devices. Clinical and administrative data acquisition, as well as medical documentation, is possible via mobile devices independent of location and thus takes place directly at the bedside. Point of Care Testing replaces the transport of samples to the laboratory and enables fast diagnostics of blood values etc., directly at the patient's bedside. With the help of smart, mobile medical devices, smaller examination units such as ultrasound, EEG or X-rays and the discussion of findings can also be moved to the patient's room.

Nursing care is facilitated by wearables, which automatically measure blood pressure, temperature, pulse, and intelligent wound care. The visit can take place via telemedicine communication, during which specialists can be called in at the same time, if required. The administration of medication and infusions can be controlled via various applications. Finally, there are also functions that can be fully automated, such as bed management for hygiene.

Outlook

Digital transformation is making its way into the patient's room, opening up numerous opportunities to significantly improve the efficiency and effectiveness of a clinic and, in particular, to improve patient and staff satisfaction.

X In order to develop the enormous potential and, above all, to meet the goals of the stakeholders, it is urgent to set the course for the single room concept in Germany. This will form the basis of the patient room of the future.

For this to happen, a new way of thinking must first and foremost be acknowledged in the political sphere so that fair financing solutions are created and two-tier medical system is avoided. The advantages of the single room clearly dominate and should be made available to every patient as a standard service. The incentive for hospitals to charge extra for this type of accommodation must cease, and instead be directed towards quality-oriented care with the use of new technologies.

References

- Bauer M (2019) Auf dem Weg ins digitale Krankenhaus. URL: <https://healthcare-startups.de/auf-dem-weg-ins-digitale-krankenhaus/> (accessed April 29, 2019)
- Berger R (2018) Digitalisierung im Krankenhaus—Umfassende Digitalisierung befindet sich noch in den Anfängen. URL: <https://www.rolandberger.com/de/Point-of-View/Digitalisierung-im-Krankenhaus.html> (accessed April 29, 2019)
- BMWi—Bundesministerium für Wirtschaft und Energie (2018) Monitoring-Report Wirtschaft DIGITAL 2018. weidner.media München
- BNP PARIBAS (2018) Der Einfluss von Leasing auf das Gesundheitswesen URL: https://leasingsolutions.bnpparibas.de/wp-content/uploads/sites/6/2018/08/Whitepaper_Welchen-Einfluss-Leasing-auf-die-Gesundheitsbranche-hat.pdf (accessed April 29, 2019)
- Detsky ME, Etchells E (2008) Single-patient rooms for safe patient-centered hospitals. JAMA 300, 954–956
- Eusterholz M (2019) Smart Hospital—das Krankenhaus der Zukunft. In: Hellmann W (Ed.) SOS Krankenhausmanagement. Kohlhammer Stuttgart
- Exner M, Popp W, Deutsche Gesellschaft für Krankenhaushygiene (2011) Einbettzimmer im Krankenhaus. Hyg Med 36(10), 400–401
- Gonser B (2015) Die Zukunft hat schon begonnen. URL: <https://medizin-und-technik.industrie.de/allgemein/die-zukunft-hat-schon-begonnen/> (accessed April 29, 2019)
- Gurr G, Stelter L (2016) Komfortstationen im Krankenhaus—Darf's etwas mehr sein?. URL: <https://www.tagesspiegel.de/berlin/komfortstationen-im-krankenhaus-darfs-etwas-mehr-sein/12962248.html> (accessed April 29, 2019)
- Leydecker, S (2017) Patientenzimmer der Zukunft. Birkhäuser Verlag GmbH Basel
- Lux T, Breil B (2017) Digitalisierung im Gesundheitswesen: bessere Versorgungsqualität trotz Kosteneinsparungen. Wirtschaftsdienst 97, 10, 687–692
- PwC—Pricewaterhouse Coopers (2014) European Hospital Survey: Benchmarking Deployment of eHealth Services (2012–2013), Final Report. European Union Joint Research Centre Luxembourg
- Reinhardt P (2018) Medizin 4.0. Digitale Revolution in der Medizin: Stand der Technik und Ausblick. URL: <https://www.devicemed.de/digitale-revolution-in-der-medizin-stand-der-technik-und-ausblick-a-758066/> (accessed April 29, 2019)
- Sauer A, Storz F (2018) So hilft innovative Technik, die Digitalisierung im Gesundheitswesen voranzutreiben. URL: <https://www.aktiv-online.de/news/so-hilft-innovative-technik-die-digitalisierung-im-gesundheitswesen-voranzutreiben-2701> (accessed April 29, 2019)
- Vbw—Vereinigung der bayerischen Wirtschaft e.V. (2019) Neue Technologien im Gesundheitsbereich. URL: <https://www.vbw-bayern.de/vbw/Aktionsfelder/Innovation-F-T/Forschung-und-Technologie/Neue-Technologien-im-Gesundheitsbereich.jsp> (accessed April 29, 2019)



Meik Eusterholz, Dipl.-Kfm.

Meik Eusterholz is an authorized signatory and Head of Business Area with a focus on healthcare at UNITY. Since 2005, he has worked on over 100 projects and designed processes in and around hospitals, simulated hospital reconstruction or the construction of new hospitals while taking into consideration the concept of “smart hospitals”. Many of his projects have received national awards. Before starting at UNITY, Meik Eusterholz conceptualized and introduced lean management processes for the automotive and machinery and plant engineering industries.



Melanie Alessandra Katterbach, MSc

Melanie Alessandra Katterbach, consultant in the focus area on healthcare at UNITY since 2018, completed her BSc in Health Economics in Cologne in 2015. This was followed in 2017 by a Master’s degree in Healthcare Policy, Innovation and Management (MSc) from Maastricht University. Since then she has supported projects related to process optimization and digital transformation in the healthcare industry.



Celina Sander, BSc

Celina Sander is studying Healthcare Economics at the University of Bayreuth for her Master’s degree (MSc). She holds a Bachelor’s degree in Health Economics from the University of Applied Sciences RheinMain. Since January 2019, she has been working as a student assistant at UNITY, supporting projects and consultants with a focus on healthcare.