



Redefining telehealth

Driving growth through remote technologies

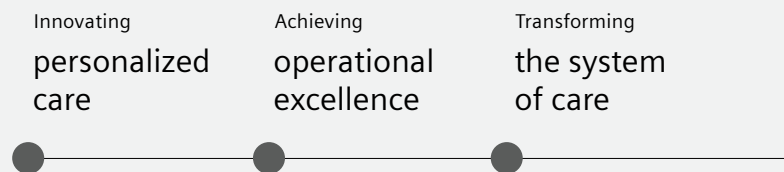
A thought leadership paper on "Transforming the system of care"
and "Achieving operational excellence"

Preface

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Executive Summary

Hospitals are facing higher financial pressure than ever before.^{1,2} While different institutions have vastly different factors contributing to their financial challenges, they all have a common foundation – increases in operating expenses are outpacing growth in revenues.

Many health systems have a traditional hub-and-spoke setup – a network consisting of an anchor establishment (hub) which offers a full array of services, complemented by secondary establishments (spokes) which offer more limited services.^{3,4} While this traditional hub-and-spoke setup for hospital networks has increased patient outreach, considerable inefficiencies exist in this model. Current inefficiencies in workforce, asset, and patient flow management have reduced local hospitals to offering merely basic services to nearby patients. However, patients are becoming consumers and are expecting faster and easier access to care. There needs to be a new way to strengthen ancillary locations to provide more advanced services so that patients can receive care faster and closer to home.

Expanding the use of telehealth makes it possible to create a new hub-and-spoke model. The current and most common use of telehealth replaces the brief interaction between patients and physicians during consultation. But the definition of telehealth is more than that. Telehealth means delivering healthcare at a distance with remote technologies. Applying remote technologies further down the patient pathway into diagnosis, therapy, and follow up can resolve current inadequacies to allow healthcare institutions to drive down costs and grow.

Remote technology can bring efficiency to many hospital departments



Remote technology can bring convenience to:

Diagnostics imaging – remote scanning enables experts to guide advanced procedures in a different location (example on p.8: University of Missouri Health Care, Advent Health)

Pathology – telepathology empowers pathologists to provide consultation from another site (example on pp.8-9: The Eastern Québec Telepathology Network)

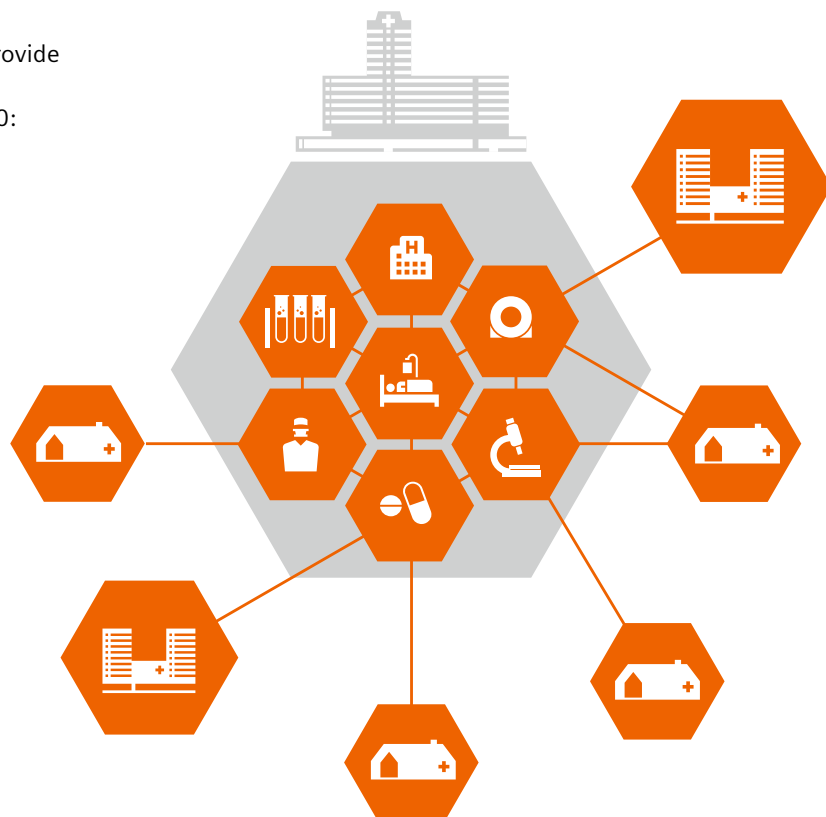
Clinical laboratory – remote data management supports laboratorians to manage multiple laboratories remotely (example on p.9: Turner Laboratories)

Pharmacy – telepharmacy allows pharmacists to provide patient counseling to locations where there are otherwise no pharmacists present (example on p.10: Mount Isa Hospital and Nebraska Medical Centre)

Surgery – remote surgery could make it possible for doctors to perform surgery from distance away (example on pp. 10-11: Apex Heart Institute)

Patient follow-up – remote patient monitoring can keep patients at home while proactively care for patients with worsening symptoms (example on pp. 12-13: Esse Health and The Heart and Diabetes Center North Rhine-Westphalia)

Telehealth not only provides the convenience that patients are looking for today, but it also connects care teams and empowers caregivers to deliver care in a more streamlined way. With a strategic use of telehealth technologies along the entire patient pathway, health systems could reduce inefficiencies and achieve their growth objectives without increasing their footprint.



Introduction

Even before the COVID-19 pandemic, the healthcare industry was already facing profit margin pressure.⁵ The pandemic has created further unprecedented financial pressures for hospitals and health systems because of additional costs associated with purchasing Personal Protective Equipment (PPE), as well as cancelled appointments and surgeries.¹

Telehealth was a lifesaver for patients who needed to consult with doctors during the pandemic. As many as 46% of patients used telehealth in 2020.⁶ Some have defined telehealth as a combination of technologies and devices to remotely gain information about a patients' health status, and it helps to decide if there is a need or urgency to intervene.⁷ This is how most people think of telehealth today: a patient is talking to a physician using a mobile device. Without a doubt, this is a leap forward in providing access to physician consultation.

Yet more appropriately defined, telehealth is the use of technologies to provide care when the patient and the doctor are not in the same place at the same time.⁸ This means patients can receive the care they need from a distance, not just to determine if they need to come into the hospital, but to receive care remotely during diagnosis, therapy, and follow-up.

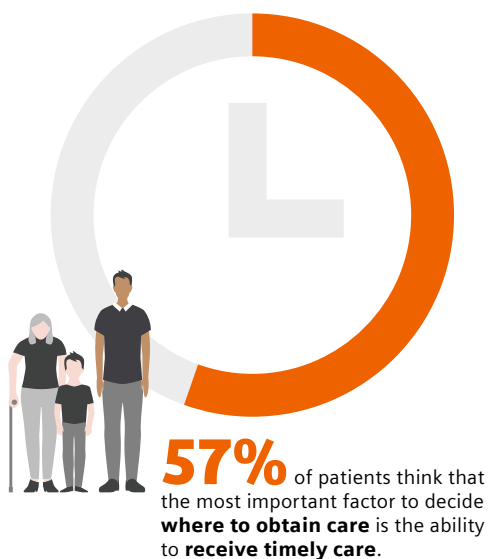
Telehealth can enable hospitals to shift the current business model and drive growth. Many hospital networks have a flagship establishment that offers a full range of services in a central location, while smaller, secondary facilities offer basic services for the local communities. Yet asset and workforce inefficiencies with the traditional organizational model exist and they continue to impact the bottom line. Expanding the use of telehealth, however, allows caregivers to work differently and more efficiently. Under this new model, community hospitals that are close to the patients no longer serve only as an outreach to direct traffic to flagship hospitals, but remote technologies can empower spoke facilities to offer advanced services and deliver the care that patients need closer to where they are.

The challenge

One of the major barriers to health system growth today is workforce shortage. Hospitals are increasingly understaffed and there is a mismatch in workforce demand and supply. United Kingdom-based publisher BioMed Central estimates a global shortage of more than 15 million healthcare workers in 2030.⁹ The continually widening gap between the increasing demand for healthcare due to an aging population, and the shortage of trained, qualified healthcare professionals makes providing care for the communities ever more difficult.

The global trend of urbanization poses additional challenges as well. Staff shortages are particularly apparent in rural areas. Hospital networks have to cover a widely spread-out region. Since it is particularly difficult to find skilled medical professionals to work in rural areas, the capital investments made in these satellite sites often experience downtime which impacts the bottom line. For example, approximately US\$222,000 revenue could be lost per MRI scanner per year due to missing experts.¹⁰ An alternative is to have skilled caregivers constantly spending time traveling to different sites to provide support, which also results in lost productivity. As a result, the ancillary locations usually offer only basic services and are not a major source of revenue. In fact, more than 470 rural hospitals have closed in the past 25 years in the U.S. alone.¹¹

Yet studies have shown that 57% of people think that the most important factor to decide where to obtain care is the ability to receive timely care.¹² There is a need to provide consistent, high-quality care across the region almost around the clock. To solve the myriad of challenges, hospital networks need to be creative in employing digital technologies to deliver more efficient care.



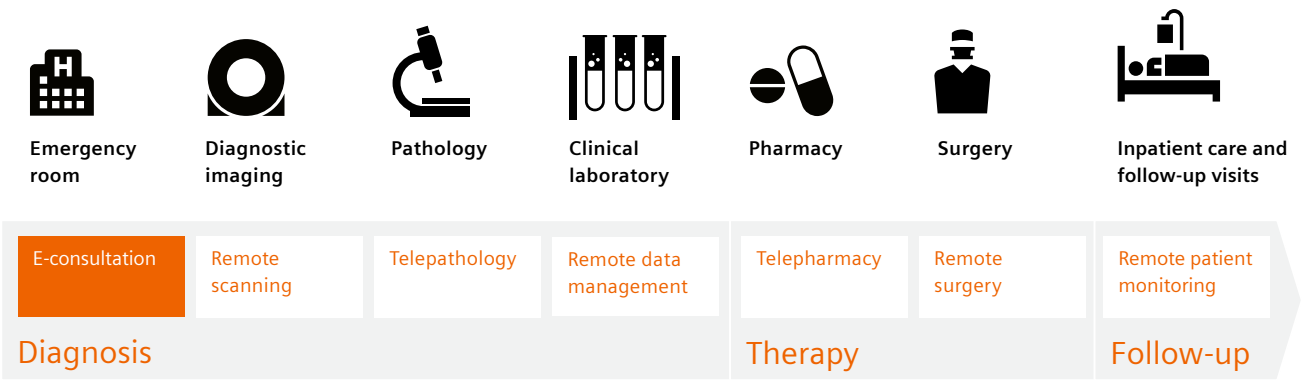
The solution

Expanding the use of telehealth, or remote digital technologies, along the patient pathway to enable caregivers to diagnose and treat patients from another location offers the possibility of a new business model to gain greater efficiencies. Flagship locations are often overcrowded and can be far away from patients. Telehealth has already improved patient flow and offers greater flexibility to providers by being an effective and safe alternative to in-person

screening in emergency departments.¹³ Extending the use of remote technologies further to diagnosis, therapy, and follow-up can reap even more benefits. By leveraging on the expert support from anywhere, ancillary sites can utilize their equipment fully and offer advanced services to care for patients in their proximity. With improved patient management, hospitals can care for more patients and achieve growth without additional real estate investment.

Figure 1: Expanding telehealth along the continuum of care

Telehealth today mainly complements the consultation between patients and physicians. Expanding the use of remote technologies to different disciplines in diagnosis, therapy, and follow-up can bring more convenience to patients and efficiencies to caregivers and help hospitals grow.



Diagnosis

Remote scanning assistance in diagnostic imaging

Diagnosis with medical imaging impacts greatly on patient outcomes. Yet highly qualified staff are hard to come by, making radiology departments a potential bottleneck in care delivery.¹⁴ To address this, the use of remote scanning in radiology is on the rise across the globe.

University of Missouri (MU) Health Care in the U.S. offers a full range of advanced diagnostic imaging in central Missouri. Three radiology imaging sites have been set up to offer services for patient coming from this wide geographic area. Appointment availability, however, is limited to only the sites where expert technologists or supervisors are present. Senior technologists have to constantly travel between locations to align protocols and provide support as not all technologists have the expertise to perform all examinations.

To overcome this inefficiency, the radiology network of MU Health Care employs a solution for remote scanning that allows medical staff to connect remotely to scanner workplaces and assist personnel at a different location. The expert technologists can support complex procedures remotely and eliminate the need to travel to different locations, which makes it easier to manage bottlenecks and offer support to on-call technologists. It also simplifies training support of less-experienced technologists. Having the ability for expert technologists to be virtually connected whenever and wherever needed, patients can choose to go to any of the three sites, greatly improving access for patients across the state of Missouri. In a similar approach, Advent Health in Orlando also expanded its service by using remote scanning to support sites located in Altamonte Springs-, Apopka-, and Celebration Hospital from a single location. With advanced examinations accessible across three

sites, Advent Health sees its revenue from cardiac examinations since the introduction of remote scanning support grow by 35%.

Telepathology

Telepathology is the practice of remote pathology through the exchange of digital pathology images. It can be used for remotely rendering primary diagnoses, second opinion consultations, and quality assurance,¹⁵ which is especially useful for areas with limited access to equipment and expertise. One example is in the province of Québec, Canada. There was a lack of pathology services for its remote area with a population of 1.7 million people spread over a vast territory. It is difficult to recruit pathologists and some departments only have a part-time pathologist or none at all.

To tackle this challenge, the Québec ministry of Health funded The Eastern Québec Telepathology Network.¹⁶ This network comprises of 24 hospitals providing oncologic surgery, of which seven have no pathology laboratory and four have a pathology laboratory but no pathologist. With this initiative, each site is equipped with a macroscopy station, video conferencing devices, a drawing tablet, and a digital whole slide scanner with images saved on a dedicated telepathology server to allow pathologists to interact with any sites. The network now enables expert opinion, intra-operational consultations, urgent biopsies, neuropathology, macroscopy supervision and has a tele-autopsy capability. The success of this network leads to plans for expansion to other regions, as well as offering tele-autopsy for remote regions so the body does not always have to be transported to Québec City.¹⁷ Telepathology can provide patient-centered pathology closer to communities as it is much easier to move an image

than to move a patient or physician. It also facilitates better organization of clinical work in a vast territory with a shortage of pathologists.

Remote data management for clinical laboratory

It is estimated that about 70% of medical decisions are based on laboratory results.¹⁸ Factors such as an aging population, increased disease surveillance and screening, a rise in new strains of infectious diseases, as well as the epidemic spread of chronic diseases are making laboratories busier than ever before. Patients need quick and near accessibility to testing, yet laboratories in smaller communities may not have the capacity to offer a full portfolio of diagnostic tests. Much esoteric or specialized testing needs to be done in centralized laboratories that could be far away, making clinical laboratory testing another potential bottleneck in the continuum of care.

Remote technology for data management allows laboratorians to manage the increasing demands in testing and offer more convenience to patients at the same time. Additional testing sites can be set up in local communities to serve nearby clinics. With the help of laboratory automation, local technologists can perform pre- and post-analytical processing while remote data management technology receives the work orders from the Laboratory Information System (LIS), downloads test orders to the instruments, intelligently processes them based on algorithms fitting the laboratory standards and then uploads results back to the LIS automatically. Remote data management software can also review results based on user-defined verification rules and automatically release results so that senior laboratorians only have to attend to exceptions or abnormal results that require manual review. With the ability for staff to view real-time data

analytics and access instruments remotely for maintenance and troubleshooting, laboratory staff can have full oversight and control of multiple laboratories from anywhere.

Dr. Gustavo Dip, technical director of Turner Laboratories in Rosario, Argentina, tells us that they expanded their clinical laboratory testing service with such an approach. Serving a city with over one million inhabitants, Dr. Dip had to expand his testing service to accommodate the growing demand. In addition to the central main laboratory in the city center, Turner Laboratories acquired two new sites that are more than seven kilometers away from the center. Experienced laboratorians are difficult to find in Argentina, yet Dr. Dip was able to manage the additional workload without hiring more senior medical technologists. The medical technologists can work from any location remotely to review exceptions that require attention. The number of remote workers has increased from 2% to 40% after implementing remote data management. The resulting turnaround time also decreased because this eliminated the need to transport patient samples during peak hours to the central location in the city center. The remote capabilities made a difference to ensure the operations kept running during the pandemic.

Therapy

Telepharmacy

Pharmacies are important as they can serve as the first level health care access points where qualified health professionals such as pharmacists can give advice to patients on drug regimens and safety. As in other disciplines, pharmacists are in shortage and there is an unequal distribution of pharmacists in urban and rural areas.

Hospital networks can adopt telepharmacy to provide pharmaceutical services to underserved areas. Telepharmacy means pharmacists and patients interact while being in different locations from one another using information and communication technology (ICT) facilities. The Mount Isa Hospital in Australia and the Nebraska Medical Centre in the Midwest region of the U.S. have deployed a remote pharmacist intervention to support underserved hospitals to ensure safe treatments for hospital inpatients.^{19,20,21} Telepharmacy can also support patients with services such as medication selection, order review and dispensing, patient counselling and monitoring. In many hospitals, the implementation of telepharmacy has led to a decrease of medication error rates.¹⁹

Home drug delivery (HDD) is a recently developed way of medicine delivery consisting in dispatching medicinal products directly to the home or workplace of patients. Remote pharmacists provide counselling for patients

who obtained drugs via the internet at home. In Spain, this service was offered to HIV (Human Immuno-deficiency Virus) patients and was managed by hospital pharmacists.²² Patients benefit from telepharmacy by saving time and money, and health systems can reduce costs by having one pharmacist covering multiple sites across a wide area that otherwise would require a higher number of pharmacies.

Remote surgery

Surgery is perhaps the most difficult part of the patient care journey to deliver remotely, but it was already explored in the 1970s with the goal to treat astronauts in space.²³ Telesurgery can eliminate long distance travel for patients, which may not be feasible because of financial restraints and travel-related health risks. Telesurgery also has the potential to provide greater access to patients especially in the rural areas as the supply of specialists there is 31% lower.²⁴

Despite the promising advancements in surgery and telecommunications, there are several hurdles to adopting remote surgery. Latency, or the time delay in transferring auditory and visual information between the two distant locations, is one of the major drawbacks because it can increase chances of inaccuracies. Even the most experienced teleoperator cannot perform with acceptable accuracy and efficiency when the

latency time is greater than two seconds.²⁵ The suitable latency time is 300 milliseconds, with less than 200 milliseconds being ideal for remote surgery.²⁶ Legal and billing issues related to remote surgery also need to be considered as laws and policies differ across state and country borders.

The good news is that patients seem to be receptive to the idea of remote surgery. In fact, 77% of patients would consider robotic surgery²⁷ and the use of robotic-assisted surgery has increased more than three-fold over the past decade and the U.S. is the largest market for this technology.²⁸ Emergent technologies are also promising to overcome the current hurdles to remote surgery. For example, the theoretical maximum speed of the fifth generation (5G) internet is a hundred times faster than 4G. High speed 5G internet incorporation with telesurgery will reduce the current latency period of 270 to 10 milliseconds.²⁹

The demand for specialized and timely access to care in India prompted Dr. Tejas Patel, Chairman and Chief Interventional Cardiologist of the Apex Heart Institute, to pioneer a telerobotic intervention study. In 2018, he conducted the world's first percutaneous coronary intervention (PCI) from a remote location outside of the catheterization lab. Five patients located at the Apex Heart Institute in Ahmedabad, Gujarat, underwent an elective PCI procedure from a distance of roughly 20 miles (32 km) away.³⁰ Each procedure was remotely

performed by Dr. Patel from inside the Swaminarayan Akshardham temple located in Gandhinagar. His partner, Dr. Sanjay Shah, was in the room with the patient at the Apex Heart Institute. The success of this study is an encouraging sign that large-scale, long-distance telerobotic platforms may soon be a realistic option for surgical procedures. Remote technology such as this could dramatically improve patient access for both elective and emergent percutaneous coronary interventions in rural and underserved populations, as well as reduce time to treatment for procedures such as heart attack or STEMI (ST-Elevation Myocardial Infarction).



77% of patients would consider **robotic surgery**

Follow-up

Remote patient monitoring for optimizing inpatient care

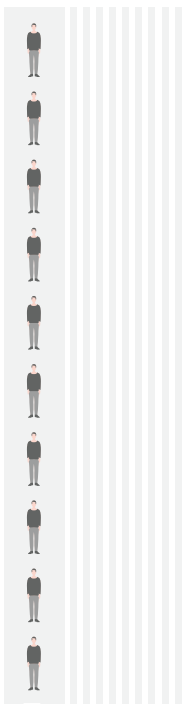
Telehealth has been useful for keeping patients at home to avoid spreading infection during the COVID-19 pandemic. Remote patient monitoring takes this advantage even further by not only moving more healthcare out of the traditional settings and to where people live and work. It also has the ability to gather a constant stream of data that provides a much clearer picture of the patients' health. Not only are patients more engaged with their health, but keeping non-high-risk patients at home avoids overcrowded emergency rooms and allows caregivers to focus on more critical cases, leading to lower readmission rates.

Esse Health, one of the largest independent primary care groups serving patients in Missouri and Illinois in the U.S. saw increasing demand on care resources, yet it was not financially sustainable to hire more staff. To solve this challenge, Esse Health uses remote patient monitoring tools to support caregivers to manage heart failure, chronic obstructive pulmonary disease (COPD), diabetes, or hypertension patients posing various levels of risks.³¹ The care team focuses on the top 5% of high-risk patients who requires hospitalization, while using device-based remote patient monitoring platform to categorize patients to high-, medium-, or low-risk groups. When a patient is identified as experiencing worsening symptoms, an alert is triggered, and a care manager then proactively contacts the patients to address the signs and symptoms.³¹ This allows care teams to focus their efforts on patients who need them most, saving time and energy while allowing them to reach more patients. Using this strategy to monitor and provide care proactively, one care manager can care for 15 times more patients while emergency room visits was reduced by nearly half.³¹

The Heart and Diabetes Center North Rhine-Westphalia in Bad Oeynhausen, Germany is also using innovative remote care service to manage patients with cardiovascular diseases. The program, known as "HerzConnect", is aimed at health insurance companies that want to offer improved treatment for policyholders with chronic heart failure³². The patient gets a certified mobile measuring device which records selected vital signs and other patient parameters around the clock, and transmits this data via a Smartphone app and a secure data connection to the institution. Data is analyzed both automatically and by specialists using specially developed algorithms, so that treatment can then be systematically optimized to suit each individual patient.³² Continuous monitoring and remote care programs such as this will enable faster response times if unusual parameters are detected and ensure improved adherence to treatment, all of which will ultimately result in better quality of life for the patients and lower the rate of unplanned readmissions.

Telehealth is also a great tool for cancer patients. It benefits frail patients who cannot travel and makes it easier for patients to obtain a second opinion. With remote monitoring tools, cancer patients can report symptoms, respond to questionnaires, and communicate with their care team as often as they would like through a mobile device. With this capability, care teams can collect highly specific, detailed information tailored to a patient's diagnosis and treatment type for more informed decision making, and the automatic patient prioritization can inform caregivers to intervene with patients who have the most critical need.³³ As remote patient monitoring might be handled by a non-physician member of the care team, it could free up doctors to spend more time with patients who are sick and need in-person care.

Esse Health can reach **15x more**
Medicare Advantage patients using
remote monitoring technology



100

Patients being cared for by one
care manager without the help
of remote technology



1,500

High- and rising-risk patients
while maintaining high
satisfaction

Conclusion

Inefficiencies in workforce deployment, asset utilization, and patient flow management impede growth for many healthcare institutions. The convenience that we experience from telehealth, however, has tremendous potential to overcome these existing barriers to business growth. The current use of telehealth gives patients the ease and accessibility to obtain consultation remotely, but remote technologies can considerably impact how caregivers deliver care by overcoming challenges such as geographical distance and expertise shortages posed by the traditional hub-and-spoke setups. As the number of patients grows, it is no longer sufficient for regional community hospitals to offer basic services and direct patients to flagship locations, but they need to be able to offer advanced and specialized care to patients as well.

Using remote technologies for various disciplines, hospitals can leverage experts across the whole network and give patients access to diagnosis early. With the advent of telepharmacy and remote surgery, patients do not need to receive treatment and advanced care by specialists only in main campuses, but close to where they live and work as well. The cost savings from more productivity from highly skilled caregivers and assets can contribute to improved profitability.

Finally, by expanding the use of telehealth in patient engagement during follow-up, it allows caregivers to give timely, proactive care to patients for better outcomes. By keeping patients in their homes, hospitals can reach and care for more patients at the same time, while reserving hospital beds for critical patients who need caregivers' focused attention. The increase in revenue more than covers the cost of telehealth investment. There are also operational expenditure (OPEX) purchasing models available for many digital health offerings which decreases the demand for capital expenditure (CAPEX).

Clearly, licensing regulations between countries or between states can hinder the availability of some services. For successful implementation of telehealth services, data security needs to be taken as a top priority. Yet with many obstacles to telehealth adoption being removed, now is an opportune time for healthcare leaders to evaluate their business objectives and determine which area can be streamlined by remote technologies. The challenge posed by geographical boundaries is no longer as daunting as before. Expanding the definition and use of telehealth offers the potential for healthcare institutions to grow and serve patients closer to their homes.



Suggested follow-up on

siemens-healthineers.com/digitalizing-healthcare

- Siemens Healthineers Insights paper issue 12: This changes everything – The COVID-19 pandemic leads to a significant acceleration of digitalization in healthcare. Available at: siemens-healthineers.com/insights/news/accelerate-digital-health-transformation.html
- Siemens Healthineers Insights paper issue 16: Who are the leaders in digital health and what can we learn from them in times of COVID-19? Available at: siemens-healthineers.com/insights/news/leaders-in-digital-health
- Siemens Healthineers Insights paper issue 21: Turning data into value; A thought leadership paper with Dr. Hee Hwang from Seoul National University Bundang Hospital on his strategic approach to data integration. Available at: siemens-healthineers.com/turning-data-into-value



Information

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Joanne Grau focuses on current trends and thought leadership content for Digitalizing healthcare. Prior to this role, Joanne has had ten years of marketing experience in Siemens Healthineers as marketing director for the diagnostics division based in New York and as Head of Marketing for ASEAN countries based in Singapore. Joanne graduated from UCLA with a degree in Molecular, Cell, and Developmental biology. Before joining Siemens Healthineers, Joanne was a research scientist in Quest Diagnostics (formerly Celera) and has authored multiple publications. Joanne is also currently a faculty member in Union University of California.



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At Siemens Healthineers, our purpose is to enable healthcare providers to increase value by empowering them on their journey towards expanding precision medicine, transforming care delivery, and improving patient experience, all enabled by digitalizing healthcare. An estimated five million patients worldwide benefit every day from our innovative technologies and services in the areas of diagnostic and therapeutic imaging, laboratory diagnostics and molecular medicine as well as digital health and enterprise services.

We are a leading medical technology company with over 120 years of experience and 18,500 patents globally. With about 50,000 dedicated colleagues in over 70 countries, we will continue to innovate and shape the future of healthcare.

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