

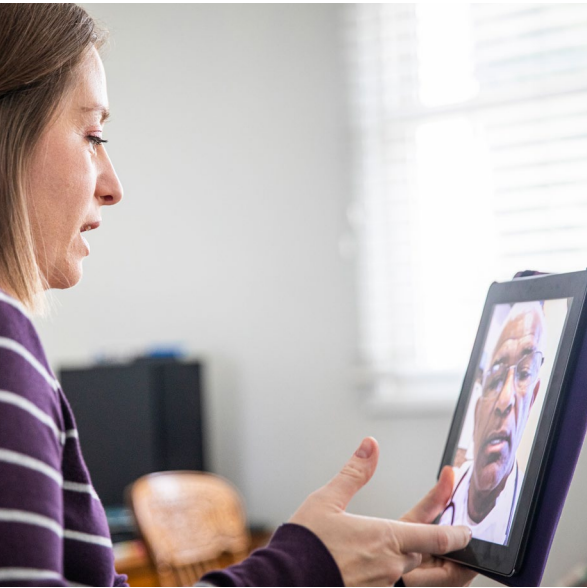


# Telemedicine and the Future of Healthcare

HOW **5G** WILL TRANSFORM TELEMEDICINE



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# 01 Introduction

The \$3.65 trillion U.S. healthcare industry is in the midst of significant upheaval. New government policies, competition from tech companies, and the COVID-19 crisis are compelling dramatic changes across the industry. One massive shift is the widespread adoption of telemedicine.

In 2018, analysts valued the telemedicine industry at \$40 billion and projected the sector would reach \$148 billion by 2025.<sup>1</sup> In 2019, 76% of U.S. hospitals used telehealth programs, including video and other technology, to connect with patients and other practitioners.<sup>2</sup> All of this growth accelerated in 2020 in response to COVID-19.

**Forrester now predicts that virtual care visits will soar to more than 1 billion this year, including 900 million visits related to COVID-19.<sup>3</sup>**

Telehealth refers to a broad range of technologies and related services to support patient care. Telemedicine refers specifically to remote clinical services.

<sup>1</sup> Source: [Medgaget](#)

<sup>2</sup> “[Fact Sheet: Telehealth](#),” American Hospital Association, 2019

<sup>3</sup> Source: [Forrester](#)

Telemedicine's role expanded rapidly amid concerns about face-to-face contact and hospital capacity. In response to COVID-19, telemedicine technology companies reported enormous surges in demand for their solutions, positioning telemedicine to play a significant role in the future of healthcare. The pandemic dramatically increased the need for high-quality and reliable mobile connectivity.

Outside of the pandemic, telemedicine's rise is likely due to many trackable benefits:

- Faster consultation times
- Lower rates of readmission
- Improved quality of service
- Patient and client retention
- Physician time and travel savings
- Better treatment plan adherence
- More referrals

A study published by the National Institutes of Health (NIH) found that telemedicine can improve the quality of care for patients with both medical and mental health conditions, resulting in 31% fewer hospital readmissions.<sup>3</sup>

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**Within seven days in  
March, 2020, U.S.  
telemedicine company  
Telemed saw demand for  
its service increase by<sup>4</sup>**

**50%**

<sup>3</sup> ["Leveraging remote behavioral health interventions to improve medical outcomes and reduce costs,"](#) American Journal of Managed Care, February 2015

<sup>4</sup> ["Teledoc Visits Soar 50% During the Past Week,"](#) The Motley Fool, March 14, 2020



## 02 Telemedicine and COVID-19

The rapid spread of COVID-19 aggressively put healthcare systems under extreme strain worldwide. To support the dramatic uptick in telemedicine, a unique and symbiotic partnership between healthcare organizations emerged. Mobility solutions helped healthcare organizations:

- **Provide Faster and Safer Testing**  
Telemedicine helps healthcare providers remotely refer patients they suspect to be infected with COVID-19 for testing.
- **Protect Physicians**  
Telemedicine helps protect physicians from contagion by limiting physicians' in-person interactions with potentially infected patients.
- **Redistribute Resources**  
Healthcare professionals in hard-hit areas turned to telemedicine to offer continued care for non-COVID patients. Some hospitals

employ telemedicine for electronic Intensive Care Units (eICU), with remote physicians treating ICU patients over video conference.<sup>5</sup> This approach allows hospitals hard hit by the virus to draw on physicians from other geographies.

According to the Wall Street Journal article, "The Doctor Will Zoom You Now," health system Ascension, with facilities in 20 states, says its online care increased nearly 2,000%, to about 10,000 visits in March 2020, from 500 in earlier months. At the Sanger Heart and Vascular Institute, part of North Carolina-based Atrium Health, 95% of its outpatient office visits moved online, for about 450 virtual patients a day.

As healthcare organizations continue to move operations online, IT leaders need to reevaluate network infrastructure and make strategic investments to strengthen and scale network capacity.

<sup>5</sup> Source: [Center for Connected Health Policy](#)



**Health systems that have already invested in telemedicine are well positioned to ensure that patients with COVID-19 receive the care they need. In this instance, it may be a virtually perfect solution.”**

*Hollander, Judd E., M.D., and Carr, Brendan G., M.D.  
The New England Journal of Medicine, 382 (2020): 1679-1681*





## 03 History of telemedicine

**Modern telemedicine evolved hand in hand with technology.**

**1950**

The Nebraska Psychiatric Institute and the Norfolk State Hospital began using closed-circuit televisions and an interactive video link to extend accessibility of care. They tested the system by conducting a full patient exam and a group therapy session using video cameras, microphones, and televisions.

**1960**

When full-color television took root in the 1960s, NASA invested in telecommunications technology to explore new ways of providing healthcare to astronauts.

**1967**

In 1967, a two-way audiovisual microwave circuit connected Boston Logan Airport to the Massachusetts General Hospital. Clinicians at

the airport used the circuit to transmit tests for examination by the hospital's physicians. These included routine surgical specimens, stained blood smears, and radiology images.

**1989**

Organizations—enabled by the internet—were able to transmit larger amounts of data. Groups such as the American Telemedicine Association (ATA) pushed for better resources and standards for telemedicine.

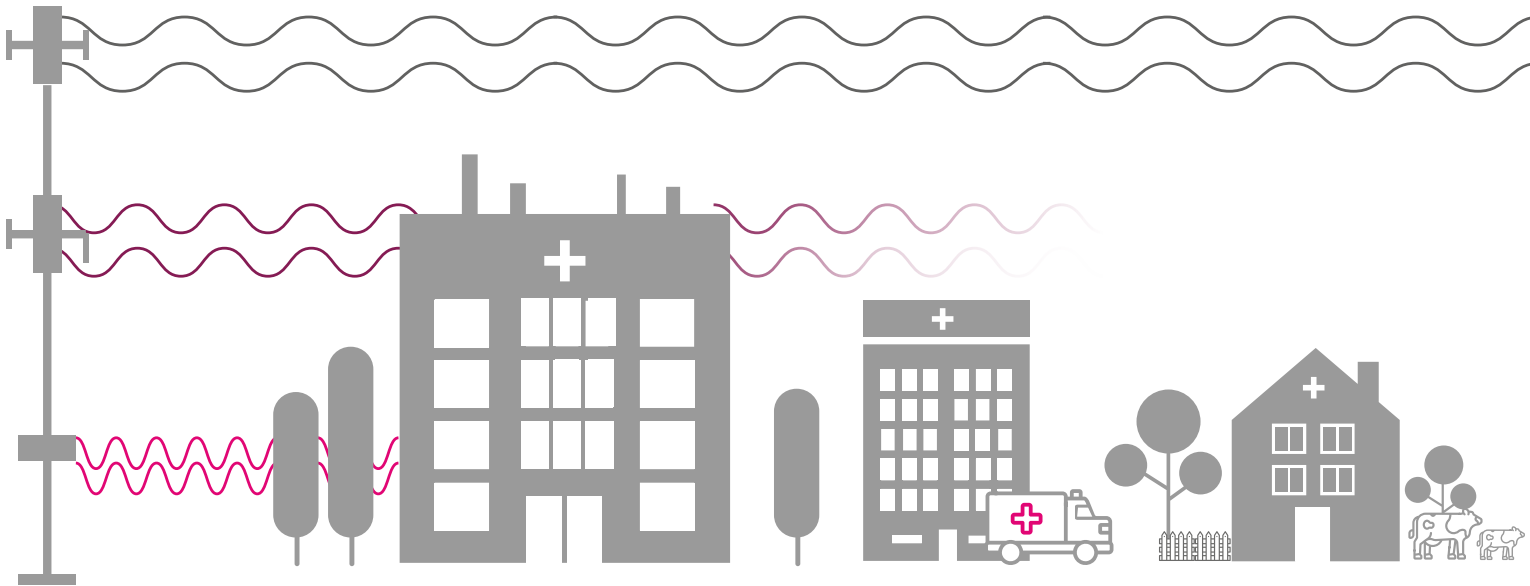
**2000**

The rise of video chat programs in the early 2000s made modern telemedicine accessible to a larger population. As broadband and mobile networks grew in capacity and reach, the availability of telemedicine followed suit. Smartphones greatly expanded this reach to the point where mobile health, health apps, and virtual doctor visits via smartphone are nearly ubiquitous.

Underlying technologies that enable telemedicine, such as image transfers and video conferencing, have existed for decades, but the limiting factor has been data transmission speeds. At the turn of the 21st century, physicians could envision robotic surgery, but healthcare organizations hesitated at the cost of laying miles of fiber optic cable to ensure its accuracy. Additionally, clinicians saw the potential for augmented reality (AR) and virtual reality (VR) to rehabilitate patients remotely; however, they've lacked the capacity and low latency necessary to deliver these applications.



**Now, 5G rollouts are increasing connectivity,  
eliminating barriers to innovative telemedicine.**



- **Low Band:** Long waves have great range and are less affected by obstacles, bringing 5G to more places—even in deep rural areas.
- **Mid Band:** Mid-length waves bring a balance between speed and range, covering a broad area with fast speeds (e.g. across a complex healthcare system).
- **High Band:** Short waves are capable of super-fast data transmission within a singular building (e.g. large hospital), but generally can't penetrate buildings.

# COVID-19, the CARES Act, and Telemedicine



The rapid spread and highly infectious nature of COVID-19 made the need for telemedicine and the network to support it abundantly clear. The \$2+ trillion CARES Act includes provisions to expand telemedicine. The act earmarks \$200 million in funding to the FCC Rural Health Care Program for healthcare providers to acquire telecommunications services necessary for telemedicine; \$25 million for the Rural Utilities Service distance learning and telemedicine programs; and the ability for the Veterans Administration to provide mental health services remotely to isolated veterans.

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## CARES Act allocations for telemedicine

**Rural Healthcare**

**\$200M**

**Rural Utilities Service**

**\$25M**



## 04

# 5G: An inflection point in healthcare

As telemedicine adoption grows and becomes more mainstream, 5G will provide the bandwidth to enable real-time, high-quality video, and one day provide the quick transmission of high volumes of data.

**5G offers a future of ultra-low latency, massive network capacity, and exponentially faster transmission speeds.**

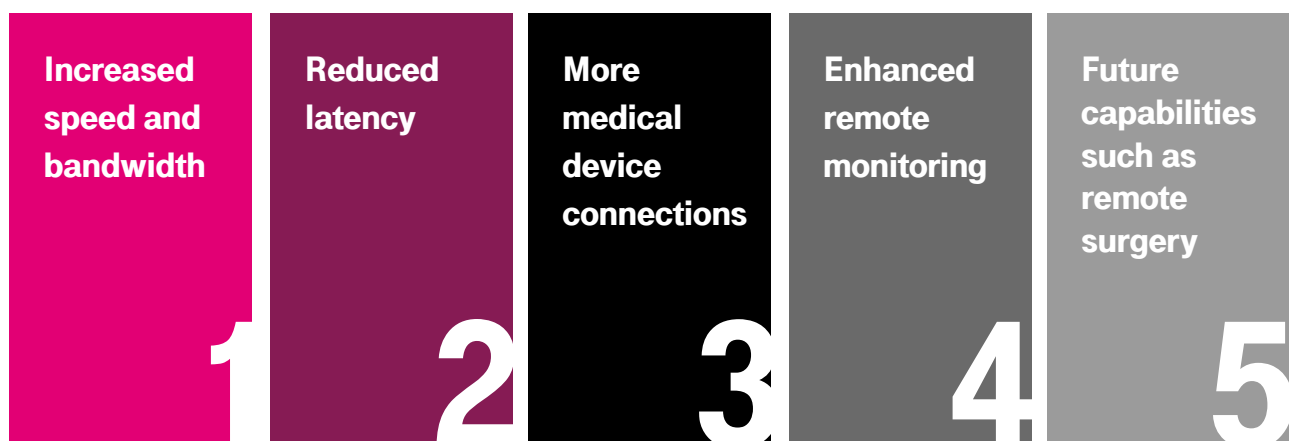
5G is the 5th generation mobile network, the evolution of the 4G network most mobile users access today.

5G has the unique potential to offer ultra-low latency, massive network capacity, and exponentially faster transmission speeds when compared with 4G.

While healthcare organizations can tap into advanced 4G networks for many telemedicine applications today, including telehealth appointments and evaluations, real-time remote monitoring, and transmissions of records, 5G will provide opportunities to both support adoption of these services and improve their efficacy, and one day offer the capacity, reliability, and low latency necessary for more sophisticated innovations.

“We’re at an inflection point right now. There are some very key technologies that we believe are critical to our future. It’s AI for healthcare, it’s connected devices, and it’s virtual care,” said CVS Chief Digital Officer Firdaus Bhathena on iHeart Radio’s The Restless Ones podcast.

“By being able to combine these technologies using the underlying infrastructure of 5G networks—and their low latency—it’s going to lead to an absolute explosion in the kinds of healthcare experiences that will truly improve people’s lives.”

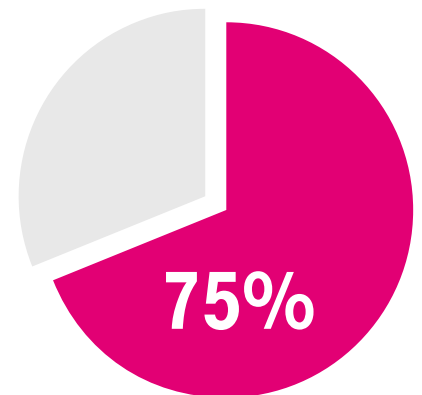


# How 5G Will Bridge the Healthcare Divide in Rural America

In 2018, only 69% of Americans living in rural areas had access to both broadband and LTE mobile services, compared with 98% of urban residents, according to the FCC.<sup>7</sup> **Within six years, the New T-Mobile will provide 5G to 99% of the U.S. population** and average 5G speeds in excess of 100 Mbps to 90% of the U.S. population.

Many providers currently serving rural populations lack sufficient internet bandwidth to deliver telemedicine services to patients. Newer and more advanced telemedicine services, such as the type of interactive videoconferencing necessary for acute stroke care, require ever-faster internet speeds, which rural providers also lack.

5G has the potential to close that gap by bringing added connectivity to small towns across America. Patients in rural areas will enjoy increased access to healthcare services if their healthcare providers keep pace with mobile connectivity upgrades. 5G-connected cloud computing will facilitate tech upgrades for rural hospitals, providing health information management and advanced reporting and billing services. 5G-enabled video connectivity will be a significant enabler for providers to increase telehealth services. With higher speeds and greater nationwide connectivity, patients will be able to virtually connect with doctors all over the globe from their own homes, regardless of their locations.



According to the Indiana Telehealth Network, approximately 75% of rural providers need faster internet speeds to fully utilize telemedicine services to treat patients.<sup>8</sup>

<sup>7</sup> [“2018 Broadband Deployment Report,”](#)  
Federal Communications Commission, February 2, 2018

<sup>8</sup> [“Growth of Telemedicine Slowed by Internet Access Challenges,”](#) Government Technology, December 3, 2019



# 05

## 5G enables new forms of teleconsultation

Video conferencing is one of the most prominent and widely used technologies in telemedicine. Through it, medical professionals address common and chronic illnesses and determine whether patients need to seek in-person medical attention.

**Consulting via video reduces costs and frees up valuable healthcare resources.**

Face-to-face interaction is an integral part of healthcare, and video conferencing enables that experience. This is true in a broad range of medical practices, including psychotherapy and other mental health applications, where a physical exam may not be needed, yet empathy and understanding are crucial.

As mobile telephony and networks advance, patients will take video teleconsultations on their



smartphones. Through these services, clinicians can diagnose and consult on a variety of cases, while patients have the convenience of anytime-anywhere support.

## **The next phase of teleconsultation will be even more convenient and sophisticated.**

AI-based health services can help tremendously—with image analysis, sensor data, and devices previously only used by healthcare providers. Imagine, for example, a parent witnessing her son pulling on his ear out of discomfort. The mother could pull out a “connected” otoscope and get an immediate readout. AI-based services could determine it's an ear infection, and notify the doctor who can then approve a prescription for pick up at the pharmacy.

In this scenario, the connected otoscope transmitting data and AI on the edge creating an initial diagnosis both leverage the 5G network to keep information moving quickly—from device to the approving physician to the pharmacy—so the patient receives near-immediate and convenient treatment.

A system of remote care that's both effective and mobile can make a tremendous difference for patients, and with connected devices, AI and 5G, it's possible to go far beyond the teleconsultations we experience today.

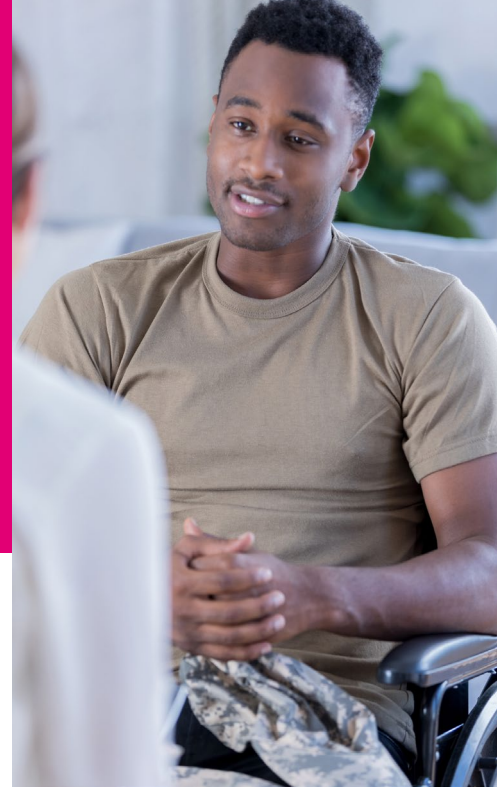
# Telehealth Expands Veteran Access to Healthcare

The U.S. Department of Veterans Affairs (VA) operates the country's largest healthcare system, serving 9 million veterans annually. But a third of its patients live in rural communities far from VA medical centers, making it difficult to deliver care.

That's why the VA's pilot of a telehealth initiative that provides veterans with a more convenient care option is so important. In seeking a partner, the VA turned to the nation's wireless carriers. T-Mobile stepped up.

The VA envisioned veterans meeting virtually with VA care providers through a videoconference platform—VA Video Connect—on any internet-equipped smartphone, tablet, PC, or laptop, from wherever they are. But one of telemedicine's biggest challenges is that medical visits depend on internet connectivity, and in rural areas, broadband internet is often unreliable or unavailable.

As the primary wireless provider for VA, T-Mobile supplied 70,000 lines of service on its network, enabling veterans to access VA care virtually. The VA delivered 2.6 million episodes of telehealth care in 2019,<sup>9</sup> positioning it as the national leader in telehealth services.



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## 70,000

**lines of service supplied  
by T-Mobile enabled  
veterans to access VA  
care virtually.**

<sup>(9)</sup> Source: [U.S. Department of Veterans Affairs](#)



## 06

# An explosion in connected devices



**Devices can track vital signs such as blood pressure and pulse, enabling physicians to make early interventions for patients prone to heart failure or other related conditions.**

The connected otoscope mentioned above gives us a glimpse into where connected health is going. Currently, healthcare organizations are using connected healthcare devices to conduct remote patient monitoring (RPM), giving patients more frequent monitoring and the ability to access services from the comfort of their homes.

Remote patient monitoring describes the digital collection of a patient's health and medical data in one location transmitted to a caregiver or clinician for monitoring in another location. RPM has become particularly useful for the management of chronic diseases. Diabetic patients, for example, can wear devices that monitor blood sugar levels and transmit data to clinicians for evaluation and trend analysis. Clinicians can incorporate these insights into future

disease management strategies. Additionally, devices can track vital signs such as blood pressure and pulse, enabling physicians to make early interventions for patients prone to heart failure or other related conditions.

RPM is often less invasive and more convenient than in-person visits, providing a vital component of a telemedicine strategy. It can also reduce the burden on the healthcare system, containing costs by preventatively reducing hospitalizations, 911 emergency visits, and other preventable medical problems.

With RPM and teleconsultations gaining in popularity, the amount of data coming in from connected devices and other sources will dwarf what we see today.

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**\$158B**

**The amount Deloitte forecasts the Internet of Medical Things (IoMT) market will be worth in 2022, up from \$41 billion in 2017.<sup>10</sup>**

<sup>10</sup> ["Medtech and the Internet of Medical Things,"](#) Deloitte, July 2018

The IoMT market encompasses a wide variety of devices that, in mature phases of 5G implementation, will take advantage of low latency as well as higher capacity. One example is a home hemodialysis system that would sit in a patient's home—it's not a wearable device, but it is a connected medical device. We will also see everyday household items that can connect to the IoMT and provide health info, such as a toothbrush that analyzes the saliva in your mouth to give a little medical check-up every time you brush your teeth.

With this level of proactive healthcare available and integrated into everyday living, people will be more likely to use it. Adoption will require a network powerful enough to accommodate connected devices in the home and the ability for healthcare organizations to receive and analyze this data.



**5G will one day support all of these connections and help healthcare become more proactive and ultimately more valuable.**





## 07

# The future of mobile health

Coupled with RPM, mobile health monitoring—colloquially “mHealth”—is more productive and accessible than ever before. The World Health Organization's Global Observatory for eHealth defines mHealth as “medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices.”<sup>11</sup>

The use cases point to convenience. Doctors can look up a patient’s entire health data on a smartphone, while patients can get text message updates on their treatment plans. Given its flexibility, mHealth can provide healthcare access for disadvantaged populations as well as hard-to-reach patients in remote or rural areas.

<sup>11</sup> [“Emerging New Era of Mobile Health Technologies,”](#)  
National Institutes of Health, October 31, 2016



Industry analyst firm Gartner predicts virtual health assistants will become one of many transformational mobile health technologies, giving patients the ability to gain valuable healthcare guidance from the convenience of their mobile phones.<sup>12</sup>

Healthcare organizations have been using virtual assistants to provide COVID-19-specific education, screening, training, and home monitoring.<sup>13</sup>

Using a combination of AI and natural language conversational interfaces, the virtual assistants have reduced unnecessary demand for acute care while supporting an influx of patients.

**Gartner predicts virtual health assistants will become one of many transformational mobile health technologies.**

<sup>12</sup> "Healthcare Technology Innovations for Identifying and Managing COVID-19 Patients," Gartner, April 6, 2020

<sup>13</sup> Source: Business Wire



## 08

# Scaling eICU services

In intensive care units in Atlanta, voices of Australian physicians and nurses fill the rooms—thanks to a program developed by the Emory eICU Center. The program, carried out in partnership with Emory Healthcare, the Royal Perth Hospital in Australia, and health technology company Philips, is designed to bring care from the other side of the world by having clinicians working daylight hours in Australia cover night shifts in the U.S.

The purpose of the program is to complement but not replace the teams at patients' bedsides in the U.S. while reducing two of the most significant drawbacks of critical care night staffing: a shortage of senior clinicians willing to cover night shifts, and the toll that working nights has on staff and their attention levels.

Clinicians in Australia use live video conferencing to alarm onsite staff in case of emergencies—in addition to performing evaluations, ordering and interpreting tests, and ordering medications as needed.

During the COVID-19 pandemic, health systems are scaling eICU services to increase their capacity to manage high-acuity patients—those with challenging medical conditions and unpredictable needs. Doing so has helped to relieve the burden on onsite staff while delivering high-quality and cost-effective healthcare services to patients.<sup>14</sup>

**Some healthcare organizations are facing inadequate bandwidth from the limitations of architectures that rely on T1 or fiber connections.<sup>15</sup>**

Moving forward, eICUs will continue to play an important role for health systems, requiring their networks to keep up. Some healthcare organizations are facing inadequate bandwidth from the limitations of architectures that rely on T1 or fiber connections.<sup>15</sup>




5G will encourage the building of infrastructure that supports the interplay of health sensors, algorithms, and smart devices, for smoother operations throughout eICUs.

<sup>14</sup> Source: [Center for Connected Health Policy](#)

<sup>15</sup> “[The eICU Is Turning Night into Day Through Telemedicine,](#)”  
The Medical Futurist, May 2, 2019

# 09 Technology requirements for telemedicine

Cutting-edge technology is essential for telemedicine to work. In particular, telemedicine needs the following:

Requirement	Description	Role of Mobile Connectivity
<b>High-speed connectivity</b> 	High-speed connectivity allows healthcare staff to view patients through high-resolution video and administer intensive services, such as acute stroke care, to rural patients.	5G mobile connectivity will eventually increase speeds by 10 to 100 times over 4G. This will enable patients to connect with healthcare providers faster and more reliably, while providers can analyze high volumes of health monitoring data in real time.
<b>High bandwidth for large-volume data transmissions</b> 	From files to prescriptions, prior treatments, conditions, and image records, the amount of medical data for each individual accumulates quickly. Asynchronous technologies help healthcare professionals access all available information to provide complete care.	High-bandwidth 5G networks of tomorrow will be able to transfer more than 2 Gbps of data at peak performance, potentially reducing lag times and future-proofing for the accumulation of data over a patient's lifetime.
<b>Digital health platforms</b> 	Remote monitoring systems (RMS) help physicians and patients stay connected.	5G networks will provide the capacity to support a greater number of devices and an increased density of devices in urban populations.

Philips estimates that half of the patients taking medications in the U.S. aren't following doctors' orders, resulting in approximately

## \$310B

in avoidable costs and \$100 billion in avoidable hospitalizations.<sup>16</sup>

### The Internet of Medical Things (IoMT)



Smart, connected medical devices and the data they track give healthcare providers real-time patient insights. Some 76% of healthcare organization executives believe IoT will transform the healthcare industry.<sup>17</sup>

IoMT devices will take advantage of 5G's increased capacity, while also enabling a density of connected devices transmitting healthcare data.

<sup>16</sup> Source: "[Philips Medication Adherence Solutions](#)," Philips Lifeline

<sup>17</sup> Source: "[The Rise of IoT in Healthcare](#)," HealthTech Magazine, 2018



# 10

## What healthcare organizations must consider now



**To innovate in the area of telemedicine, healthcare organizations must have a competitive technology infrastructure.**

Healthcare organizations face new opportunities along with new challenges, including changing regulatory requirements, security threats, fraud, and competition from new companies moving into healthcare. Tech titans such as Google, which purchased Fitbit in November 2019, as well as organizations such as Amazon, Publix, and Walgreens, have been aggressively moving into telehealth and diverting revenues from traditional healthcare organizations.

Most healthcare organizations lack the infrastructure to scale virtual care and telemedicine to meet consumers' appetites for virtual care services. Scaling virtual care requires a rapid and focused plan, with benefits that can impact crisis outcomes in the near-term, in addition to supporting a healthcare organization's operating model and growth opportunities in the middle- and long-term.

To innovate in the area of telemedicine, healthcare organizations must have a competitive technology infrastructure, including reliable in-hospital network coverage; virtual care capabilities, including remote data sharing and video conferencing; secure systems; and ease of use for patients, especially those new to telemedicine.

## Regulatory requirements

IT leaders must also consider regulatory requirements, being aware of HIPAA guidelines on telemedicine contained within the HIPAA Security Rule.<sup>18</sup> These outline security requirements for telemedicine communications. In addition, IT leaders should be aware of recent changes in Medicare. In light of COVID-19, Medicare provided waivers to better enable 40 million seniors on traditional Medicare to access doctors via teleconsultations. Previously, Medicare covered telehealth visits only in some rural regions. As of 2016, only about 0.25% of traditional Medicare beneficiaries used telemedicine. Post-COVID-19, seniors' use of telemedicine is poised to change dramatically, and some analysts say it's unlikely Medicare will revert to its limited telemedicine policies post-pandemic.<sup>19</sup>

<sup>18</sup> "[Security and HIPAA](#)," American Academy of Allergy, Asthma & Immunology (AAAAI)

<sup>19</sup> "[Information on Medicare Telehealth](#)," Centers for Medicare & Medicaid Services, November 15, 2018



## Security threats and fraud

Security threats, fraud, identity theft, and intentional invasion of privacy are notable concerns related to telemedicine. To address these issues, healthcare organizations need to adopt platforms that employ end-to-end encryption, which allows only an individual and the person with whom the individual is communicating to see what is transmitted. Platforms must also support individual user accounts, logins, and passcodes to limit access and verify participants. Additionally, users should be able to assert some degree of control over capabilities, such as choosing to record or not record certain communications or turn off audio or video signals. Additional security features to consider include:

- **Intrusion Detection Systems (IDS)**  
From complex host-based detection to lightweight network-based detection. Generally, any credible IDS will provide core functionality designed to detect known bad activity based on known signatures.
- **Web Application Protection**  
Such as a Web Application Firewall (WAF) to protect internet-facing websites and applications.
- **Log Management**  
Solutions to provide the broadest coverage related to HIPAA mandates.
- **Other Technologies and Solutions**  
Such as fully encrypted data transmission, peer-to-peer secure network connections, and no storage of video.



# Next steps

Given the cost and care benefits of telemedicine, health IT leaders should consider how to scale telemedicine and virtual care in their organizations. Areas to consider include scaling health system capacity through technologies such as virtual health assistants, teleconsultations, connected medical devices for remote patient monitoring, and eICUs.

Gartner analysts also recommend that healthcare technology leaders map out potential scenarios facing their organization to help prioritize investment in critical technology that can help meet requirements in the near- and long-term.<sup>20</sup>

**To truly empower telemedicine technologies, IT leaders will also need a network that can scale to accommodate current and future innovations in telemedicine.**

Bandwidth, latency, and speed of data transmission have been limiting factors to telemedicine. As the 5G revolution unfolds, we will see rapid advancements in innovations that help healthcare organizations deliver the highest-quality care while ensuring the wellbeing of clinicians and staff.



**T-Mobile.com/  
business**

<sup>20</sup> [“Healthcare Technology Innovations for Identifying and Managing COVID-19 Patients,”](#)  
Gartner, April 6, 2020