

Introduction

The emergence of the COVID-19 pandemic in the spring of 2020 disrupted the healthcare industry like never before. However, it also brought about a paradigm-shifting change in how physicians and patients alike think about the effectiveness of telehealth and other aspects of digital healthcare. In particular, Medicare-generation patients considered at greater risk for COVID were encouraged to use digital technology for self-monitoring of chronic conditions at home. Over time, they saw that remote patient monitoring (RPM) and virtual visits still gave them quality care outside of traditional medical facilities plus the comfort level of face-to-face contact with the doctor.

Patients of all ages, in fact, have grown to accept that virtual visits are easy to do and far less risky than traveling to a clinic and sitting in a crowded waiting room, potentially being exposed to pathogens. Deloitte estimates that the percentage of virtual visits will increase to 5% globally in 2021 – or by 8.5 billion physician visits – compared to a pre-pandemic estimate of 1% in 2019.¹

The “smart hospital” emerged as a successful and growing segment in healthcare during the pandemic. Even as COVID abates, hospitals are looking to grow and expand virtual healthcare services, as well as create a safe and seamless experience for patients who must physically visit the hospital for clinical visits and testing services.

Recent research forecasts a very favorable future for smart hospitals and a growing demand for telehealth and RPM solutions:

- Projections from research firm Market Research Future indicate that the global smart hospital market will reach USD 77,299.6 million by 2025, with a 21.5% CAGR during the forecast period of 2018-2025. A factor driving this growth is a strong demand for IoT technologies.²
- Market intelligence and advisory firm Modor Intelligence forecasts that the telemedicine market will reach revenues of USD 168,396 million in 2026, representing a CAGR of 28% between 2021 and 2026.³
- According to consulting firm McKinsey & Company, the use of telehealth has grown and stabilized by 38x than during the time period before the COVID pandemic.⁴
- Current research by Insider Intelligence forecasts that 30 million patients in the U.S. will be using RPM devices by 2024.⁵

This white paper will discuss how evolving applications of Internet of Things (IoT) technologies are driving several trends to support future growth and innovation for smart hospitals. It will also look at the ways that digital health technology for telehealth applications is expanding from the realm of clinics and provider practices to smart hospitals, including next-generation RPM solutions for post-acute patient care at home.



Today's Smart Hospitals: Evolving with IoT and Telehealth Innovations

To digitally transform a hospital into a smart hospital starts with a single, integrated platform of IoT technologies. Only then is it possible to create a digitally transformed, connected organization that benefits patients, doctors, medical personnel and operations teams. With IoT sensors connected to surfaces or worn on patient wristbands, it is possible to monitor the status of patient beds, operating room equipment, medications and vaccines, parking, HVAC, lighting, and more.

Using a secure, HIPAA-compliant dashboard or mobile app, clinicians and administrators have complete visibility of what is happening throughout the hospital – patient rooms, operating theaters, location of medical equipment, at-risk patient monitoring, and more. Today's smart hospitals are achieving the benefits of improved patient care and hospital efficiencies, including:

- Enabling more effective care team collaboration
- Making quality, remote post-surgical care available at home
- Enhancing physician/patient engagement
- Ensuring a safe, exalted patient experience
- Increasing hospital building efficiencies to reduce costs
- Gaining complete visibility of the hospital and its services through a network of connected IoT devices

Telehealth and RPM, both integrated components of a smart hospital platform, remain established modalities of care even as the pandemic continues to subside. Beyond using RPM for remote monitoring of chronic conditions at home, hospitals have started to realize the benefits of RPM for post-surgical and acute care patients recovering at home. In addition, despite the wide acceptance of telehealth and virtual visits, sometimes patients must physically go to the hospital for tests, scans, lab work, physical therapy, and other in-person appointments. Although the availability of COVID vaccines decreases the risk of contracting the virus, smart hospitals are looking at smart technologies, such as real-time location services (RTLs), to make it easier and safer for patients to access the care they need.

In light of these new insights gained from the challenges of patient care in the time of COVID, the following digital healthcare trends enabled by an integrated smart technology platform stand out as shaping the future of smart hospitals:



- **RPM for the Hospital at Home** – RPM for managing patients' chronic conditions at home, such as diabetes and hypertension, is a widely accepted modality of care established during the pandemic. RPM technology automatically collects data from the patient's at-home medical devices and transmits it to a physician dashboard via an LTE-enabled cellular connection. Smart hospitals are taking advantage of this proven RPM technology to discharge post-surgical patients to their homes earlier, where they can recover in a less stressful and a safer environment. In this "hospital at home", patients receive quality care from visiting nurses and/or family members who use secure telehealth services to collaborate virtually with the physician and care team. Furthermore, these connected devices collect and send patient metrics, which are monitored and analyzed both by the platform (to raise alerts as needed) and by medical personnel (to make decisions about patient care). By shortening the patient's hospital stay, the hospital reduces the risk of exposure to hospital-borne infections and viruses, including COVID-19, which could require readmissions or emergency care.

Recent findings published in the *Annals of Internal Medicine* prove that RPM for the hospital at home delivers the promised benefits. A 2019 pilot study was undertaken by Boston's Brigham and Women's Hospital to gauge the effectiveness of the home hospital mode. The randomized controlled trial found that home hospital care can reduce costs and readmissions while at the same time increase physical activity when compared with traditional in-hospital care.⁶

Smart hospitals are also seeking RPM solutions specifically for intensive care units (ICUs) so they can offer remote care to ICU patients who may be able to complete their recovery at home. This approach could potentially make more ICU beds and ventilators available for COVID patients and others who are more critically ill. RPM solutions for ICUs also enable budget-restricted and short-staffed hospitals to collaborate with outside resources for skilled nurses to ensure consistent critical care for in-patients. And the lack of available resources is expected to escalate in the future. Despite an estimated increase of 40 million health-sector jobs by 2030, The World Health Organization (WHO) projects a global shortfall of 9.9 million physicians and nurses.⁷

- **Smart Navigation for Safer, More Efficient Outpatient Visits** – The lingering threat of COVID is motivating hospitals to make outpatient visits safer and a stress-free, minimal-touch experience. Using a secure mobile app designed around the needs of the patient, patients can access their appointment information before leaving home. Using real-time location services (RTLS), the app provides turn-by-turn driving directions to the hospital, the nearest parking lot, and even the closest available parking space. Patients can also access walking directions from the lot to the exact location of their appointment in the hospital building. The app automatically checks in the patient, so patients avoid close personal interaction at intake. In the exam room, patients receive alerts on how long they will be waiting to be seen, while the physician and nurses are also alerted that the patient has checked in and is waiting in the exam room.

After the appointment, the physician may prescribe medication, or a test in the hospital lab or imaging department. The patient mobile app once again gives step-by-step directions to the pharmacy or lab, and will even send a reminder to the patient if they are late or appear to be leaving without fulfilling their obligation. This is just one way that smart hospitals can use digital health technology to ensure a safe, seamless and elevated patient experience.

Zyter Delivers Remote Tele-ICU Monitoring Solution

A global U.S. military healthcare system implemented Zyter's secure mobile RPM solution and secure collaboration platform for use by intensive care units (ICU) physicians and nurses at all of the system's medical centers around the world. Zyter's RPM solution meets stringent U.S. Department of Defense (DoD) security requirements and is compliant with HIPAA and other global healthcare regulations. Zyter RPM also integrates with the medical system's electronic health record system.

Today, Zyter's RPM solution continues to transform the way that ICU physicians and nurses care for critical patients across an international network of military hospitals. Using the Zyter RPM solution on a daily basis, nurses at the U.S. medical center can remotely monitor ICU patients at the Okinawa hospital, for example and immediately collaborate with the on-duty nurses thousands of miles away using secure video chat when a device alerts any change in the patient's vital signs. As a result, ICU staff can respond faster to the patient's issue to provide a higher quality of care and bring about a better patient outcome.





- **Wellness Kiosks: Expanding Healthcare to Underserved Areas** – The emerging trend of self-serve wellness kiosks enables hospitals, clinics and pharmacies to expand telehealth services to rural areas or any geographic locations where Internet availability is poor, or traditional healthcare appointments are difficult to access. Patient populations in regions with high rates of chronic diseases, such as diabetes, can also benefit from easier accessibility to regular remote monitoring.

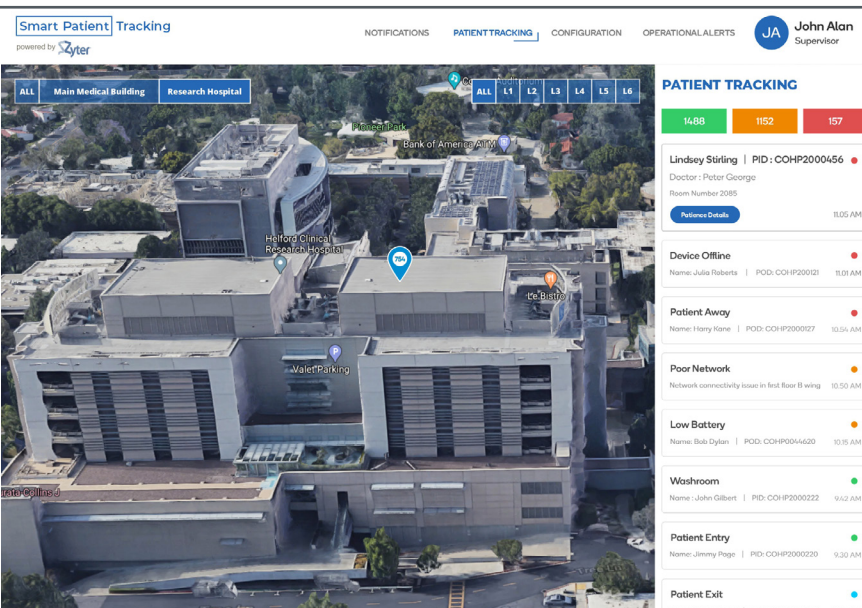
Patients can have their vitals taken at the wellness kiosk set up in a local shopping mall, grocery store, or any often-visited public location. The vitals are securely stored to the patient’s EHR and transmitted via an LTE-enabled cellular device to a physician for review. If necessary, the physician can initiate a virtual visit with the patient at the kiosk and recommend a care plan, or advise the patient to seek emergency care. With wellness kiosks, smart hospitals can make care more accessible to a greater number of people, when and where they need it – and gain a competitive advantage as an innovative and easily accessible healthcare provider.

Enabling the Digitally Connected Hospital: Zyter Smart Hospitals™

Zyter Smart Hospitals™ is an end-to-end intelligent solution that connects a hospital’s disparate data systems, departments, people, and the latest Internet of Things (IoT) technology devices on Zyter’s robust digital communication and collaboration platform. Designed to help hospitals meet all of the challenges of virtual healthcare today and in the future, Zyter’s integrated IoT-enabled platform provides the latest technologies for creating the smart hospital ecosystem:



- **Remote Patient Monitoring** – Zyter Smart Hospitals integrates RPM to enable physicians to monitor the condition of post-surgery patients at home, resulting in a reduction of hospital readmissions. Pre-programmed, LTE-enabled home medical devices track and transmit patient physiologic data to the physician. The physician receives an alert if the patient’s readings are out of range and can act quickly with a virtual visit to resolve the issue before it becomes an emergency.
- **Mobile Navigation for a Better Patient Experience** – Zyter’s wireless-enabled, patient-facing mobile hospital navigation app employs RTLS technology to ensure that outpatients have a minimal touch experience whenever they go for an appointment or procedure at the hospital.
- **Hospital Bed Device Monitoring** – Zyter Smart Hospitals collects and integrates patient metrics from all of the different medical devices that are connected to the patient in the hospital bed – such as oxygen rate, heart rate, blood pressure and more. Nurses receive intelligent alerts on any changes to the patient’s condition so they can respond with prompt care.



- **Patient Tracking** – To improve patient safety, Zyter Smart Hospitals also detects and alerts staff whenever a patient, who is a flight risk because of medical conditions like dementia and Alzheimer’s, attempts to leave the designated area of a hospital or exit the hospital building. Additionally, Zyter’s seamless integration with IoT wearables can provide patient data on exercise, sleep patterns, and electrocardiograms to help physicians more quickly diagnose emergent issues and intervene sooner.
- **Asset Monitoring** – Zyter Smart Hospitals provides a single interface for better visibility, condition monitoring, control and safety of all medicines, blood, organs and vaccines, as well as the real-time location availability of critical medical assets such as wheelchairs, defibrillators, and more. Smaller than a penny, Zyter’s wirelessly-connected asset monitoring devices can attach to an EpiPen or small vaccine bottle to constantly monitor the temperature and alert on any changes. Zyter Smart Hospitals can also monitor the chain of custody of a vaccine.

- **Smart Facilities** – Zyter leverages transformative technologies such as 5G, artificial intelligence (AI) and IoT to ensure smart energy management, including lighting, power supply, smart meters, HVAC and wireless power. In addition, vision analytics include smart surveillance through video cameras to detect patient/staff movement, unauthorized access and unidentified object detection.

Conclusion

Living with the threat of COVID has taught the world that it’s possible to provide quality, personalized healthcare virtually without in-person human interaction. Smart hospitals that adopt new strategies for providing virtual care through RPM, telehealth services, and IoT-enabled technologies will be well-positioned to improve patient safety and satisfaction, while optimizing operational efficiencies and growing competitively in post-pandemic times.

With Zyter Smart Hospitals™, Zyter is taking a proactive role in bringing new opportunities for growth to U.S. hospitals, as well as to healthcare organizations in developing countries where smart digital healthcare technologies are not yet deployed. By partnering with local IoT device and medical equipment vendors, Zyter is taking steps to make it easier for smart hospitals to become a much needed reality in other parts of the world.

For more information about Zyter Smart Hospitals™, visit <https://www.zyter.com/iot/>

About Zyter

Zyter delivers a wide range of Internet of Things (IoT) solutions spanning buildings, stadiums, campuses, and even cities. As the foundation for the Qualcomm Smart Cities Accelerator Program, the Zyter SmartSpaces platform supports solutions for multiple markets including healthcare, education, logistics, retail, travel, and construction. By integrating and consolidating data from IoT devices and applications, organizations can gain new insights to improve efficiencies while providing end-users with an engaging digital experience. In 2021, Zyter won more than 37 global awards for its IoT products including Best Technology and Company Innovation of the Year. Founded in 2017, the privately-held company is based in Rockville, Md. For more information, please visit www.Zyter.com/iot.

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