

THE FUTURE OF HEALTHCARE BUILDINGS

*Envisioning the patient experience in an era of artificial intelligence,
the “internet of things” and virtual healthcare*

Presented by



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DESIGNING FOR A BETTER PATIENT EXPERIENCE IN TOMORROW'S HEALTHCARE BUILDINGS

Looking to 2019 and beyond, healthcare leaders must track the rapidly evolving sector on myriad fronts. Amid a constant flow of genomic startups, they wield a growing understanding of the science behind data and are learning better ways to utilize clinical informaticists and artificial intelligence. They must adapt to healthcare reforms, engage the “internet of things,” ensure price transparency and pursue a strategic approach to the patient experience. And the list goes on.

In June, we shared perspectives from more than 25 healthcare thought leaders on how their organizations are addressing the move from the old volume-based model to value-based care, and to the advent of virtual health in hospitals. In this second healthcare report, 21 thought leaders relate how the design of hospitals and related facilities incorporate virtual health, artificial intelligence, and the internet of things to elevate patient experience.

The many disrupters that have emerged in healthcare in recent years have come with challenges but have introduced numerous design changes that improve the patient experience. In 2018, disruptions from firms outside traditional healthcare increased, and this may be just the beginning of advancements beyond our imagination. In the four months after we co-authored our report on the transition to value-based care, the industry saw 255 more mergers – many revolving around data collection and interpretation capabilities. Mega deals including Cigna and Express Scripts, CVS Health and Aetna, and Amazon’s acquisition of PillPack compel conventional healthcare companies to rethink their strategies.

We trust you will find this report insightful and actionable. We thank everyone who contributed time and input, and we welcome your feedback to help shape future white papers. Enjoy!



Mike Zorich

Principal
IMEG



Daina Pitzenberger

Senior Vice President
Healthcare Advisory Service
Transwestern



Lisa Feeley

Vice President
Construction Management
Transwestern

21 **THOUGHT LEADERS.**

13 **ORGANIZATIONS.**

4 **RECURRENT THEMES:**

DATA, DATA, AND MORE DATA

With the rapid integration of wearables, virtual health and artificial intelligence, we will all have more data to interpret and use.

FLEXIBILITY

The future is fraught with unknowns, and it can take years to construct a new hospital. That's why our respondents seek greater flexibility in their space, both to accommodate current healthcare delivery and to ease adoption of new approaches in the future.

TECHNOLOGY

Whether it is equipment, radio-frequency identification (RFID), wearables or apps that help us do more with less, we must keep up with technology. Virtual health will play an increasingly significant role in the delivery of healthcare.

DECENTRALIZATION

Last but not least, the move to smaller facilities will continue, along with incorporation of more services. The medical offices and clinics of the future will be smarter buildings.

DATA, ARTIFICIAL INTELLIGENCE AND OTHER DISRUPTERS

The U.S. population already generates 2.5 quintillion bytes of data per day. Accenture estimates the artificial intelligence (AI) health market will grow to \$6.6 billion by 2021, and key clinical health AI applications could save the U.S. healthcare economy \$150 billion annually by 2026.

Artificial intelligence is being adopted more readily because we are starting to see a full ecosystem around it. While hospitals have always focused on patients, the spotlight is now on the patient experience and its effect on outcomes.

Respondents say virtual health is coming, but adoption will be slow until U.S. policies "reimburse" and "motivate" hospitals for its use. We think faster implementation is preferable. The bottom line is that technology disruptions will continue – the question is, how quickly?

There is growing interest and demand for artificial intelligence and virtual healthcare. Share with us a disruptive strategy that your organization has implemented or is implementing in the near future. Explain how this strategy will help improve the patient experience/outcome and/or help the healthcare facility owner improve the delivery of healthcare.

Kurt Stahl, Senior Vice President, Healthcare for **Hunt Construction Group** stated that their team has been working to prefabricate building components so parts may be changed out to reduce downtime to hospital owners. He noted “these parts reduce the risk of infection to the patient as it cuts down on drywall dust and dirt usually associated with renovation work.”

HKS is exploring how AI can be used to enhance projects and the experiences of those who work, visit and most importantly heal within hospitals. **Phyllis Goetz**, Chief Strategist noted that “much of our learning at HKS comes from other industries and centers around enhancing personalization for patients. Virtual Healthcare is impacting all components of facilities. Patients enjoy greater convenience, more access, and lower costs, while the medical staff experience more flexible schedules and improved access to patients and information. The mobile platform is quickly establishing itself as a tool for patient education, monitoring, and early identification, and we are utilizing virtual consults and digital education throughout many of our healthcare projects.”

The further advent of smart buildings will be more prevalent so building materials, systems, and management of such will play a larger role. **Andrew Quirk**, SVP Healthcare, and his **Skanska** team are focused on helping their owners understand how buildings will begin to manage themselves in the future and be healthier for their inhabitants.

At **HopProperties**, integration of virtual reality into design to increase user group engagement is helping clients with the improvement of ‘wearables’. **Chris Hopkins** shared that his team is partnering with medical equipment planners to integrate the information from these devices. “These allow healthcare facilities to be more flexible in these

changing environments.” In addition, HopProperties is focused on identifying, justifying and testing corroborating data to allow our clients to take advantage of technological advances.

While the interest and demand are growing, there is much risk in adopting bleeding edge technologies. Like all strategic decisions, **BT Stuck**, Experience Design Leader at **IU Health** says “our team will look to the earliest of adopters to build awareness and evaluate what might be a best fit for our strategy and what we should prioritize. Internally, we will likely focus on technologies that will reduce operational costs and create better outcomes in alignment with our mission. Externally, we will likely focus on technologies that support patient engagement among existing patients and growth among those we don’t yet serve.”

“In a time where clinician burnout is a concern to our owners, easing workloads and reducing their stress is another positive outcome of virtual health. In more rural settings, virtual care is not just a convenience, but provides a connection to caregivers that patients might not otherwise be able to access.”

- Phyllis Goetz, HKS

At **Novant Health**, **David Park**, SVP Construction & Facility Services stated “we have already established MY CHART for patients and healthcare professionals to communicate online. We also have online appointments and ‘nurse’ call centers to get information at any time.”

In the future, Novant will likely have healthcare kiosks throughout the communities with direct access to healthcare professionals. "It is our belief that in time many healthcare issues will be successfully handled without the patient's need to visit a medical facility."

"With the current uncertainty in payment structures, the need for even more efficient use of revenue generating spaces is driving facilities to use sensing to better understand space utilization. Our team is focused on helping our owners with this need."

- **Michelle Ossmann**, PhD, MSN, Steelcase Health

Patient experience is inextricably linked to the quality of the relationship with the clinical team. **Steelcase Health** believes that a key part of that face to face experience is eye contact and attention, both of which are negatively affected by documentation practices – the EMR. **Michelle Ossmann**, PhD, MSN, *Director, Health Environments*, believes that "voice documentation and assist can affect patient experience and outcomes by allowing the clinician to focus on patient-family communication, suggest question prompts if certain phrases or findings are related to a particular disease state, all while providing accurate documentation to support continuity of care."

The facility owner's role becomes one of providing the proper infrastructure and space design to support new modes of care, both virtual and in-person, essentially creating the structure to support process and outcomes.

As architects who work regularly in Healthcare, **Tina Larsen**, *healthcare leader* from **Corgan Architects** understands how AI can automate almost all of the data collected from the patient, incorporating it into the medical record and alerting when adverse combinations are entered such as potential drug interactions. When asked about disruptive technologies, she responded that AI "can generate predictive analytics based on proposed treatment

protocols based on patient history. It is also believed that it can detect changes in verbal cues that could detect stress and anxiety leading to appropriate interventions.

Some feel that AI could someday replace human interaction in some settings however, we believe healthcare is still a "people" business so likely this exciting technology will augment the patient journey thereby improving the experience and outcome."

The collection, analysis and use of data by healthcare organizations has grown and will continue to grow as we move forward. **IMEG** has identified improvements and invested in how we effectively utilize the data we have collected on our projects over the years and more importantly, how we will collect and utilize data moving forward. "The more information we can provide to our healthcare clients about a specific building type, location, specific infrastructure systems, operational costs, efficiencies, etc., says **Mike Zorich**, *Principal*, "the more it will help them make informed and cost-effective decisions earlier in the design process, saving the team time and money, resulting in positive impacts for the patients and staff within new and renovated facilities as they are brought on line."

"Our team at **Transwestern** is building flexibility into the physical buildings which allows for changes in staffing due to AI, virtual healthcare, and the change around in-office patient volume and space utilization," noted **Justin Brasell**, *Executive Vice President*.

Examples of this flexibility include exam rooms, physician offices, consult rooms and procedure suites which are all built off of the same base dimensions so that exam rooms may be expanded or contracted or re-purposed without any disruption to the clinic. Additionally, sufficient base building power is brought in, as well as vertical risers design and constructed to accommodate increased fiber runs for the increased demand for internet speed and capacity soon-to-be required by users.

Telemedicine is predicted to attract 7 million users by end of 2018 and is estimated to grow by 14.3% by end of 2020. An overwhelming 90% of healthcare executives responded that they have recently or soon will be implementing a telemedicine or virtual healthcare program.

One of our thought leaders, the **University of Mississippi Medical Center** was a very early adopter. UMMC began offering specialty care through telehealth in 2003 when it launched a 'teleemergency' pilot project. The program was created to meet the dire need for specialized care and other public health services in the state's most rural corners. The Center for Telehealth was launched a decade later, in 2013. Over the years, the initial effort has mushroomed into a network of partnerships with hospitals, clinics, schools and businesses statewide.

Patrick Casey, *Executive Director of Planning, Construction & Design* at **UMMC** explained that "we provide telehealth services to over 200 locations throughout the state of Mississippi and offer 35 specialty services. This improves the patient experience and care delivery in multiple ways: 1) It provides specialized care to remote patients and rural hospitals and clinics when needed; 2) it provides healthcare to patients who cannot get to a health center; and 3) it allows caregivers to monitor patients remotely." UMMC has shown improved outcomes and reductions in emergency room visits through the use of telehealth.

Rod Booze, *healthcare leader* at architecture firm **E4H**, says AI and virtual healthcare is quite exciting, and the firm anticipates that infrastructure systems will become more flexible and have greater ability to connect multiple device types to an internal network managed by AI. Rather than have separate, dedicated systems for tracking staff and materials, systems will begin to rely on wearable devices and phones to detect the location of staff, physicians and patients within the buildings. AI will be utilized to predict the trends and flow of patients and staff within facilities.

"We have seen a 25 percent reduction in rural emergency room staffing costs and a 20 percent reduction in unnecessary transfers. This helps improve the delivery of healthcare by lowering costs and treating patients in their communities. We call it 'everywhere care.'"

- **Patrick Casey**, UMMC

"Internally, we will likely focus on technologies that will reduce operational costs and create better outcomes in alignment with our mission. Externally, we will likely focus on technologies that support patient engagement among existing patients and growth among those we don't yet serve."

- **B.T. Stuck**, Indiana University Health

Utilizing tracking information within common devices, institutions will be able to analyze the flow of patients and staff within their facilities and couple that information with simulation software and predictive algorithms to generate real-time spaghetti diagrams of the processes within their facilities.

"We believe AI, in the future, might help implement lean processes in a consistent manner as adjustments are implemented and analyzed, helping facilities reach their goals by adjusting current practices and designs and predicting outcomes for future strategies and facility designs," he said.

CHANGES AHEAD FOR THE BUILT ENVIRONMENT

Longstanding challenges for architects, engineers and builders include staying informed of the newest trends, helping owners understand what's coming, and ensuring designs will meet user needs at the conclusion of construction, which may be as much as two years in the future.

In addition to these challenges are those posed by regulations, such as the Tax Cuts and Jobs Act (TCJA), which was signed into law in December 2017 and will affect every aspect of healthcare with the repeal of the individual mandate in the Affordable Care Act.

Industry experts have predicted a significant increase in the number of uninsured individuals and in the amount of uncompensated care costs. We expect continued consolidation and acquisitions of physician practices in order to control costs. Consumerism and value models are here to stay.

Given these defining constraints, what do thought leaders expect from the next generation of healthcare buildings?

Focusing on medical office buildings, free-standing emergency departments/urgent care centers and hospitals, what are three things that will be different about the healthcare building of the future versus today's healthcare building? Why?

HUNT CONSTRUCTION GROUP

1. Smaller regional hospitals for inpatient care.
2. One facility for diagnostic and treatment functions.
3. More home/telehealth will become common practice, with doctors/nurses working from a call center.

"Deloitte states, 'in the next decade, only 50 percent of current health systems will likely remain.' This constant state of consolidation is impacting the types of facilities in a health system's portfolio and the aesthetic continuity they strive to achieve."

- Erin Peavey, HKS

HKS

1. Increased personalization – Patients are looking for a higher level of service from all the businesses they interact with, and healthcare is focusing on how we can personalize the patient experience, delivering more meaningful, relevant moments from a more knowledgeable perspective. Consumers and patients are also demanding greater inclusion in healthcare decision making, accessing their own health data and connecting their healthcare experiences.
2. Increased Focus on Flexibility – With so much uncertainty in the market, investing in flexibility is paramount.
3. Consolidation – Continuing over the last few years, we see rapid consolidation, not just of health practices and systems, but also the addition of insurance and other care providers. New entrants are joining the health marketplace at an increasing rate, with funding and logistical knowledge to create game-changing practices.

Consolidation is driven by significant technology innovations, the pressure to meet financials and the ever-changing market dynamic.

SKANSKA

1. Outpatient facilities will become more and more prevalent and complicated.
2. These facilities will also not be a typical medical office building – they will further become multi-specialty centers.
3. We will see buildings incorporate more data management and connect to more homes via virtual medicine.

HOP PROPERTIES

1. Wired monitoring of patients or visible monitor screens are a thing of the past, because wearable technology will allow physicians to monitor patients with a heads-up display, creating an environment that will allow patients to concentrate on healing.
2. Instantaneous and continuous triage – From the moment you walk into any healthcare facility, you will be monitored through artificial intelligence, increasing staff efficiency, reducing wait times and increasing patient satisfaction.
3. Integration of Traditional Medicine with Modern Acute Care – Traditional medical providers will be used by disrupters to circumvent closed healthcare systems.

NOVANT HEALTH

1. MOB's of the future will be smaller, with less lobby and waiting space. The total number of examination rooms may be reduced. The healthcare professional will need more time to work both online and virtual. For the general practitioner, I predict the facilities will become smaller and leaner in design, with less need for large waiting rooms, and potentially reduce the number of exam rooms. We are striving for a seamless experience across channels, virtual and physical.

2. Specialty clinics will become more decentralized away from the main campus allowing for easier access by the communities to more localized specialty care.
3. Remote emergency departments, urgent cares, express clinics will continue to grow and healthcare providers will partner with and/or joint venture with retail providers to provide healthcare more conveniently and less expensively to the patient.

"Can a grocery store become a healthcare building? We'd say, yes."

- Jordan Smith, Steelcase Health

STEELCASE HEALTH

1. The definition of a healthcare building will expand beyond medical office buildings, emergency departments/urgent care and hospitals to include building types that effect a more contemporary notion of health.
2. The built environment will respond to patient and clinician needs in both overt and subtle ways, perhaps influencing mood and adjusting to age and mobility requirements, actively creating affordances for better clinician/patient interactions supporting better health outcomes.
3. The coordination between all these settings will require sensing capabilities to make meaningful recommendations, reducing waste and increasing satisfaction.

CORGAN ARCHITECTS

1. Healthcare spaces must be designed to care for the caregiver, offering task-specific work spaces, ergonomic work spaces, amenities and especially places of respite. The patient experience will improve with improvement in staff satisfaction and reduction of physician burn-out.

2. Spaces will be set up with virtual-visit technology, so that providers can see patients that arrive as well as those that are present through an app, within the workflow. These virtual technologies also allow the patient access to consults with a specialist that isn't anywhere near the facility.
3. Wearable apps will monitor chronic health issues and alert patients for proactive care and improved outcomes. These metrics will be accessed by the healthcare provider upon arrival or via telemedicine for immediate treatment. For low-acuity patients, there will be a focus on keeping patients vertical – in a chair rather than on an exam table – which can improve the patient-provider encounter as well as the communication.

"For the general practitioner, I predict the facilities will become smaller and leaner in design, with less need for large waiting rooms, and potentially reduce the number of exam rooms."

– **David Park**, Novant Health

IMEG

1. Data collection and storage by healthcare providers will continue to increase. The sharing and accessibility of this data will lead to changes in space utilization within our buildings and changes to the infrastructure to support this need.
2. Collaboration and elimination of silos will lead to creative care solutions, shorter treatment times and reduced costs. Facilities that combine researchers, healthcare providers and technology providers as well as pharma and key medical consumable suppliers can promote healing, prevention and overall better care for patients.
3. Facilities will need to be flexible to accept the current state-of-the-art equipment for treatment and diagnostics, but at the same time, be easily adaptable to accept the next generation of equipment or care model being developed, with minimal impact to the physical building and ongoing operations.

TRANSWESTERN

1. There will be more flexible floor plates with standardized column spacing, more windows and higher ceilings. This allows for ultimate flexibility as well as for a better staff and patient environment, which will promote wellness and a healthy work habitat.
2. There will be more flexibility within the clinic's physical construction (i.e., partially constructed with modular walls). This will allow flexibility as uses, patient flow and staffing change.
3. Technology will be critically important and will fill the physician clinic so that patient throughput may increase, and space can be utilized as effectively as possible (think touch screens in each exam room, with built-in cameras for video conferencing or telemedicine, and automatic patient check-in technology linked to cell phones).

UMMC

1. Most care will be shifted from hospitals to lower costs. In the future, all medical office buildings, free-standing emergency departments/urgent care centers and hospitals will have some component of telehealth.
2. The buildings will continue to become smarter and sustainable. Efficiency and the need to reduce cost will drive these trends. As we see continued escalation of construction costs and energy costs, those who build smarter and more sustainable buildings will have a competitive advantage in the future. It will require evaluating the total lifecycle cost of the buildings rather than the initial capital investment.
3. Increased focus on resiliency as healthcare facilities are part of our critical infrastructure. They must remain operational during natural disasters and endure catastrophic events to provide uninterrupted care to existing patients as well as care to those affected by these events. Designing buildings so that critical infrastructure is protected, with implementation of flood gates and use of resilient and durable materials, will become standard in future healthcare buildings.

E4H

1. Medical office spaces will become increasingly adaptive, assigned based on schedules and less on fixed boundaries of practices. This will allow physician practices the ability to scale their footprint based on scheduled visits rather than maintain costly, fixed leases.
2. Expansion of telehealth will offer opportunities to start assessments of patients before they arrive. This will become an important way for institutions to better manage the population of patients using emergency departments and urgent care centers for primary care.
3. The market for wearable devices will begin to feel an increasing push for FDA approvals and the ability for apps that collect data from these devices and communicate it to the electronic medical records of healthcare providers. An emergency department visit will begin with a review of this data to look at information like heart rate, oxygen saturation and temperature before the patient even leaves their home. Assessments will be based on a greater span of information including metrics such as weight, body mass index, skeletal mass, activity levels and other data points that can be collected and communicated through connected home devices, thus speeding the intake process.

AFFILIATED ENGINEERS (AEI)

1. Flexible and resilient infrastructure – Flexible, adaptable spaces will become the standard as departments expand and move throughout a facility. Mechanical, electrical and plumbing infrastructure design must change to meet the needs of these services. Disruptive events, such as natural disasters, pandemic outbreaks, and human-generated disasters – expose vulnerabilities and represent growing risks to the operation of a modern hospital. Our future facilities must address these concerns uniquely and thoroughly such that preparedness for, ride-out of and recovery from disruptive events are resilient, safe, and swift.
2. Must use predictive analytics – The ability to proactively diagnose infrastructure issues before they happen will become the standard in the future versus today's reactive operational procedures, which severely limits the effectiveness of healthcare operations staff. Water-use reduction measures. The escalating cost of water and growing public awareness about its future availability establish water as a primary engineering design concern. Our future healthcare facilities must target at least 50% less potable water use in order to be responsive to this under-attended and under-valued public utility.
3. The use of more high performance materials, fixtures, technologies and systems that reduce building energy load and/or water use will be required in future healthcare buildings. Similarly, systems that reuse waste heat within the building or use waste water from one element as the water source for another will become far more financially appealing in future healthcare facilities.

HEALTHCARE DESIGN INFLUENCERS

In a recent article, *The New York Times* reported that 10 of the largest tech companies in the U.S. were involved in healthcare equity deals worth \$2.7 billion, up from \$277 million in 2012. Hand in hand, quantified health will continue to shape healthcare. That's because health that is measurable can be better improved, and data tracking affects performance, making it wise to take advantage of quantified health technology.

The internet of things facilitates objective measurement and tracking of health for better outcomes and will play an increasing role in the design and operation of medical properties.

Beyond technology, trends affecting medical properties include the increase in healthcare employment, needed to care for the growing population that is 65 years old and older. This age group will surpass 21 percent of the U.S. population by 2022, according to the Centers for Disease Control.

Demand for medical space is shifting from hospitals to more affordable outpatient facilities (i.e., physician offices, diagnostic labs, and surgical centers, etc.). Ambulatory surgery centers were the fastest growing segment in the U.S. for the past 12 months.

In September 2018, Transwestern estimated the economy could add more than 150,000 healthcare practitioners during the next two years. Demand for medical office space in the U.S. for physical, clinical, mental and dental services could range anywhere from 150.5 million square feet to 225.8 million square feet, as per estimates by MedSpace.

As of the second quarter of 2018, there was 110 million square feet of available or under-construction medical office space in the U.S. indicating a potential, serious shortfall. "Absorption of this demand is impossible," said Elizabeth Norton, Transwestern's Managing Research Director, Mid-Atlantic Region.

There are alternatives, Norton suggests, such as leasing conventional office buildings where there is ample space available. Repurposing empty retail spaces for medical use is another. Norton also points to the emergence of new forms of healthcare, such as telemedicine, digital health and shared service centers, as options that "could suppress future demand to some degree," depending on how quickly these nascent approaches catch on within the healthcare sector.

Earlier this year, marketing intelligence firm Transparency Market Research estimated in a report that the U.S. telehealth market would expand by nearly 15 percent to \$2.8 billion by 2025. "North America is projected to dominate the telehealth market driven by government incentives, technological advancements, and efforts of key players to expand their market presence," the report stated.

Identify two trends impacting the design and development of healthcare spaces.

AEI has been following two trends: Those are type of care, which will change preventative treatment centers to smaller, more intensive treatment centers (i.e. cancer, hospice); and the location of facilities (the shift from big cities vs. small towns).

Erin Peavey, Associate Architect & Researcher at HKS, asserts that customer choice and building a memorable and positive experience is driving profitability and human centered design, which affects market share, profitability and reputation.

"We are seeing more integration of mental and behavioral health," he said. "We've long understood that the mind and body are interdependent, and our healthcare organizations are increasing their focus on these facilities, recognizing the need of spaces designed to treat and nurture people with mental and behavioral health challenges."

The solutions may look different depending on whether we are talking about an ambulatory care center or an academic medical center, but the trend towards integration has arrived in full force.

Quirk of Skanska says that disruption from outside the industry is the biggest influence on design, and a significant opportunity. "What will a healthcare facility that is managed by Amazon, Berkshire, Walmart and Apple look like? How will they be built? Will they even require buildings?"

The other trend, he says, "continues to be technology and how it will shape our environments. At some point soon, we expect to see technology better inform how our facilities are designed and built."

Hopkins of HOP Properties notes the trend among members of Generation X and Millennials toward using midwives; the comfort and personal touch of a 'house call' in a high-acuity-capable facility is made possible with advances and accessibility of wearable technologies for physicians and patients.

Flexible space design is an absolute must in the current transitional healthcare environment, he contends. Providers are being asked to do more with less, and when combined with the moving targets of satisfaction and reimbursement, this is requiring flexible space design that has a vision of the future.

"Disruption from outside the industry is the biggest. What will a healthcare facility that is managed by Amazon, Berkshire, Walmart and Apple look like? How will they be built? Will they even require buildings? This is a significant opportunity in the industry."

- **Andrew Quirk**, Skanska

In Indianapolis, **IU Health** believes that more integrative approaches allow for activation testing, and that change throughout the design process is important. Through coordinated planning efforts, end-users/clinicians will help shape the processes and operational flows of the future while fleshing out the physical space design – and more importantly informing that design. In addition, **Stuck** expects further inclusion of patients and family members in design. "Journey mapping experiences to design partnerships and review boards comprised of patients and families, architecture and design bastions are transitioning out of the 'expert' mentality and are starting to embrace participatory design methods and design thinking approaches that focus on creating human-centered solutions rather than just client-centered or operational-focused solutions."

It is essential to have a strong focus on construction costs and design. In North Carolina, **Novant Health** is constantly looking for innovative ways to lessen square footage while increasing volume throughput, Park says. "For the future, healthcare design is focused more on

"Flexibility of space is of utmost importance, so standardization of room dimensions and a 'pod' layout for decreased staff requirements has definitely been a trend. Additionally, the focus on bringing in natural light throughout the space is a fairly recent trend, which started in the office sector, but is merging into healthcare as patients demand a more relaxing and healing environment."

- **Justin Brasell**, Transwestern

being patient friendly, less wait time, better coordinated scheduling and easier facility for the patient to find their way."

Seth Starnier, *Advanced Explorations Leader at Steelcase*, points to personalized care at scale. "That is, meeting people where they are. If systems wish to encourage people to interact with healthcare, and view care as a series of continuous interactions, then health spaces need to integrate into people's lives."

"Within our Steelcase Health teams, we believe this happens with digital and physical touch points (e.g. integration in cities, schools, workplaces, leisure), that are decidedly not 'typical healthcare.' In addition, technology continues to advance," he says.

Design Researcher **Jordan Smith** says change is inevitable, unpredictable and transformative. "Physical spaces need, therefore, to move with technological shifts. Flexibility becomes a key enabling factor by minimizing disruption and providing agility."

Corgan is designing facilities that will be multispecialty centers offering a full array of diagnostics. A mix of universal exam rooms and consult spaces maximizes room utilization and efficiency and reduces the exam to provider ratio needs. Utilizing consult rooms rather than traditional exam rooms for patients not needing a physical exam allows the provider to better integrate technology as a communication tool with the patient. This allows use

of virtual specialist and IA during consultation. Utilizing radio-frequency identification technology in light fixtures allows tracking of staff and patients for improved workflow and efficiency, resulting in improved patient satisfaction.

Hearing from doctors and patients at **UMMC, Casey** confirms that flexibility and adaptability are now requirements for the design of all healthcare spaces. He adds: "These design characteristics enable the space to incorporate changes brought about by advancements in technology and care delivery models as well as being able to convert spaces in the future without major remodeling costs."

AEI responded: "As engineers, we at AEI must address resilience in hospitals by providing fully redundant systems and satisfying regulatory requirements for emergency back-up systems. The increasing frequency of storms at a major hazard-event scale indicates that additional, more effective strategies are needed. Nuanced analysis of climate, context, mission, values, and program is necessary for today's healthcare project team to assess the need for and attributes of the resilience aspects of the design. Today's healthcare facilities can be 60 percent more energy efficient largely by reducing the need for reheat."

One trend that **E4H** sees is the move to take the care and expertise to the consumer in a traditionally retail-driven approach. The irony is, bigger players are pursuing smaller and more tailored solutions to maintain and capitalize market share and brand presence. Access to care and value-based economics have placed health systems in a difficult position. "The traditional destination, bricks-and-mortar medical center campus approach represents a potentially limiting strategy for healthcare systems," said **Julissa Telez**, **E4H's Director of Business Development**.

Consumer demand and the retailing of healthcare are shaping delivery alternatives, she says. Consumers are frequently expecting patient-centered design that offers choices, promotes transparency and capitalizes on technology. Consumers expect choice and opportunity closer to home. Convenience is the driver which retail has followed in response to consumers for decades. Retailers

"We will see an increase in healthcare facilities that may never see a single patient. These spaces will include facilities to support telemedicine and virtual medicine, remote monitoring of patients, and facilities that are designed to support and maintain vehicles and equipment for mobile outreach care."

- Eric Vandenbroucke, IMEG Engineering

have consistently been striving to meet and exceed consumer expectations. Speed of response and quality of experience are environmental differentiators. While healthcare has been slow to embrace those lessons, the trend is unmistakable.

To that end, healthcare will continue to be further dispersed in consumer retail applications – scaled down and targeted to consumer preference. That preference will include location and proximity. Walgreens, Walmart, and other retailers will continue to actively add "scaled" component healthcare responses in the form of clinic and pharmacy options. Community- and even neighborhood-based healthcare models are here to stay, she says.

Jason Carney, *Healthcare Leader* at **E4H**, added: "The culture of consumer-driven healthcare will rapidly advance. The increasingly sophisticated and educated healthcare consumer will continue to demand access to high-quality healthcare in convenient proximity with the best amenity and quality of environment. The potential for significant impact on a health system's future, in response to the changing economics and clinical delivery of healthcare (read culture), is exciting."

TOWARD SMARTER HEALTHCARE PROPERTIES

In an increasingly interconnected world, end users have come to expect a retail-like experience from nearly every commercial building they enter, including healthcare facilities. As hospitals become smarter and more connected, they will use data and insights to improve daily operations, patient care and comfort. This serves as a compelling reason to explore the possibilities of the internet of things.

In discussions with all of our thought leaders across the U.S., we heard consistent emphasis on the need to be ready to accommodate new equipment and technology. Below is a summary of what they held up as the most important factors in developing, designing, building, and managing “smarter facilities” in the age of fast-moving technology.

The “internet of things” is impacting the design and construction of commercial buildings, and healthcare properties are no exception. What are the most important factors to consider as medical facilities need to get smarter?

- We must consider timing and early integration of technology, from the selection of real estate through the design and construction process.
- Rigid structures that don't allow for easy infrastructure or wall changes will not be able to adapt to new technologies – whether they come in the form of above-ceiling wiring or the need for smaller or larger spaces.
- Everyone involved in the design and construction of facilities must plan for complete and true integration of technology. As consumer devices proliferate in our daily lives, the data collected should allow for identification and an increase in our knowledge base of health trends, allowing for earlier detection of disease.
- Making healthcare affordable means we will need to have better control over our operating costs at the facility level. Making the buildings far more functional, from a square footage to a person ratio, will continue to push our versatility and design for both clinics and acute-care facilities.
- Prepare your buildings for an ever-expanding IT infrastructure - this means flexibility and investments in data scientists to make meaning out of the internet of things.
- Security is one of the most important factors related to internet-of-things-connected medical technology. Any devices brought into the healthcare system provide opportunities for cyberattacks. This is important, because it is delaying the adoption of technology that can bring improvements to the system and the patient care.

"The medical office building of the future will need to be as flexible and energy efficient as possible. With the ever-growing need for smart buildings and technology to support patient care and clinician communication, the spaces need infrastructure planning that supports the ever-changing technology and equipment needs. Also, with consumerism driving healthcare service delivery, design teams are challenged to create spaces that positively impact patient satisfaction and outcomes."

- Daina Pitzenberger, R.N., Transwestern

- Internet-of-things devices are very important to building mechanical and lighting controls and automation, reducing energy costs. In healthcare, these devices have the potential to positively impact the maintenance, diagnostic capabilities and testing of equipment and systems tied to life safety and patient care.
- As we become more reliant on the collection and exchange of data from devices and equipment within a facility or at connected remote sites, downtime will not be tolerated. This is especially important for healthcare facilities as it can mean the difference between a correct diagnosis or an incorrect assessment.
- Downtime or delayed response time will not only result in lost revenue, but will also have a far greater negative impact on patient care. The security and reliability will not only focus on the network connectivity, but also on all of the supporting systems such as cooling and heating equipment, essential power distribution, and fire protection systems that support these installations.
- Technology is excellent in many ways but is never a substitute for a friendly face. As the patient experience continues to become more and more important and as providers rush to answer the call, we must keep in mind that automation and efficiency is necessary, but should never replace a knowledgeable, available, and friendly interaction with a practice's staff.
- Telehealth will become a common component of every medical facility in the future as video conferencing with our doctor's office will become as common as video chatting now is with our family and friends.
- The pace of development in technology makes brick-and-mortar facility adaptation appear to move at a geologic pace. The ability for facilities to envision new ways to update and change will continue to grow in importance.
- A matrix of elements, tracking the pace at which they are able to adapt, will allow facilities to look for opportunities to implement planned updates of their facilities over time. This approach is similar to the development of technology and software, with planned minor updates occurring multiple times between major changes in new versions.
- Initiatives on reducing waste will need to be woven into this approach and become integral to the selection of components of the various upgrade stages. A flexible technology backbone system will need to allow medical devices of varying ages and manufacturers to connect and communicate.
- An increasing emphasis on the availability for multiple forms of communication will continue, not only for staff and providers, but for patients. Assessments such as cellular surveys will become a more common part of the process for choosing locations.
- The convergence of record data, analytics, genomics and value-based payment for services is fundamentally redefining the concept of facility flexibility from assumptions of episodic change to a state of comparatively continuous change. As analytics show better outcomes, care and treatment models continuously evolve, ultimately driving facility requirements and building form.
- Risk management associated with pre-investment in future paths is now looking at low-cost "fast-fab" interiors and modular interface technologies within a shell facility branded as an experiential setting, supported by changeable building cores and plug-and-play systems from a stock set of parts.



Center for Neurorestoration and Neurotechnology Research, Providence, Rhode Island

"The retailing of healthcare is a battleground for the healthcare consumer. Organizations are competing in the same space to improve patient experience, maintain consumer confidence, and entice consumers with convenience and proximity. Providers are saturating communities with scalable healthcare in smaller and less expensive outpatient and inpatient options."

- **Julissa Tellez**, E4H

"There are two common focus points that are discussed in every article, whitepaper, blog, and book that I have read in the past two years when highlighting the future of healthcare, and they are data and patient experience. Clearly, everything is becoming more personalized because we are sharing more of our personal data with everyone!"

- **Lisa Feeley**, Transwestern

CONTRIBUTORS



HEALTHCARE SYSTEMS / ACADEMIC MEDICAL CAMPUSES / PROVIDERS

Patrick Casey | Executive Director of Planning, Construction & Design | University of Mississippi Medical Center

David Park | Senior Vice President, Construction & Facility Services | Novant Health

B.T. Stuck | Experience Design Leader | Indiana University Health

COMMERCIAL REAL ESTATE / ARCHITECTS / ENGINEERS / CONSTRUCTION MANAGERS

Rod Booze | Healthcare Leader | E4H

Justin Brasell | Executive Vice President | Transwestern

Jason Carney | Healthcare Leader | E4H

Phyllis Goetz | Chief Strategist | HKS

Chris Hopkins | Principal SVP | HOP Properties

Tina Larsen | Healthcare Leader | Corgan Architects

Michelle Ossmann, PhD, MSN | Director, Health Environments | Steelcase Health

Erin Peavey | Associate Architect & Researcher | HKS

Greg Quinn | Principal | AEI

Andrew Quirk | Senior Vice President of Healthcare | Skanska

Jordan Smith | Design Researcher | Steelcase Health

Kurt Stahl | Senior Vice President, Healthcare | Hunt Construction Group

Seth Starner | Advanced Explorations Leader | Steelcase

Julissa Tellez | Director of Business Development | E4H

Eric Vandenbroucke | Senior Principal | IMEG

Mike Zorich | Principal | IMEG



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