THE CHANGING HEALTHCARE LANDSCAPE
Insights for Real Estate + Facilities Leaders
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Trends Impacting Healthcare Real Estate &amp; Facilities</td>
<td>4</td>
</tr>
<tr>
<td>A CEO’s Perspective on How to Prepare for Disruption</td>
<td>9</td>
</tr>
<tr>
<td>How Modular Construction is Transforming Healthcare</td>
<td>14</td>
</tr>
<tr>
<td>Reducing Energy While Adding Space</td>
<td>17</td>
</tr>
<tr>
<td>The Future of Smart Buildings &amp; IoT</td>
<td>19</td>
</tr>
<tr>
<td>Using Process Neutral Design to Elevate the Patient Experience</td>
<td>24</td>
</tr>
<tr>
<td>Strengthening Community Engagement for Better Building Outcomes</td>
<td>28</td>
</tr>
<tr>
<td>Changing the Physician Workplace Paradigm</td>
<td>32</td>
</tr>
<tr>
<td>Designing Facilities with Well-Being in Mind</td>
<td>35</td>
</tr>
</tbody>
</table>
A SEISMIC SHIFT IS UNDERWAY IN HEALTHCARE.

Converging forces—from accelerating tech to rising consumer expectations—are disrupting the traditional healthcare ecosystem, introducing diverse new players, markets, and opportunities.

With these exciting innovations also comes a wave of unprecedented challenges for those who plan, build, design, and operate the growing variety of spaces where healthcare is delivered. For future-facing health systems, breaking down silos is the only way forward, which is why HealthSpaces brings together traditional health systems with retailers, skilled nursing, ambulatory care providers, and more with the industry’s leading suppliers.

Once a year, this diverse group of thought leaders convene in an intimate setting to explore creative approaches to the greatest facilities and operational challenges facing healthcare organizations today. This whitepaper summarizes the innovations and ideas exchanged at HealthSpaces ’18.
KEY TRENDS IMPACTING HEALTHCARE REAL ESTATE & FACILITIES

A myriad of forces are transforming the traditional healthcare model, from new technologies and rising consumer demands to a growing market for outpatient services. While these innovations present exciting opportunities, they also create new challenges for the real estate and facilities executives who plan and operate the growing variety of spaces where healthcare is delivered.

At HealthSpaces, Brian Weldy, Vice President of FacilitiGroup Infrastructure Solutions at HCA, led a discussion centered around how health systems across the country are addressing these changes.

The conversation focused specifically on:

“How is the transformation of healthcare impacting real estate and facilities?”

Participants included:

• Kip Edwards, Vice President, Facilities Services - Banner Health
• Brad Lahr, Division Chair, Department of Facilities and Support Services - Mayo Clinic
• Cindy Zelis, Vice President, Ambulatory Operations and Telehealth - University Hospitals Cleveland
THE DIVERSIFICATION OF REAL ESTATE PORTFOLIOS

Weldy kicked off the session by exploring how healthcare real estate portfolios have undergone dynamic changes in the past five years. As health systems continue to expand their footprint and move closer to the patients, Weldy asked about the unique challenges that have emerged.

Banner’s Kip Edwards shared that there’s been tremendous growth in many areas: the actual number of facilities as well as the building types and variety of customers. Banner used to have 300 to 350 active projects underway at any given time; today, that number has grown to 470. The workload has dramatically increased, yet project teams are expected to work at a faster pace. The growing variety of project types has made this an even greater challenge.

“With so many new locations and building types, from ambulatory care to urgent care centers, our teams are stretched too thin. Our current challenge is to restructure our teams by specialization so that they understand the specific project nuances and can accomplish them with speed,” Edwards said. He shared that providing employees with iPads and vehicles in some cases helped to create a more mobile workforce and reduce the need for running back and forth between multiple locations.

Edwards also brought up another challenge: housing multiple business units and customers in one building. “We have to learn how to be more cohesive through various markets. Right now, they’re all racing in parallel. Joint ventures can make the decision-making process more complex.”

Cindy Zelis echoed the challenge of creating a sense of cohesion despite the growing complexity of today’s facilities.

“The challenge is to break out of our silos and stop operating like individual tenants.”

“When a consumer walks in the door, they don’t know the different stakeholders: they believe it’s all your health system. At the end of the day, we all have the same mission, so diversification really must align around the patient experience,” she said.

Weldy then asked the group their thoughts on who will own the ambulatory facilities of the future. The overall consensus was that there will be a shift from traditional transaction structures toward a mix of owners and third-party operators. Participants agreed that while diversified ownership offers undeniable benefits, the emergence of new challenges is also inevitable, such as ensuring standardized security measures and maintaining a strong, persistent brand.
MASS CUSTOMIZATION

The conversation then moved to the topic of mass customization. Patients are demanding it...but can an industry as complex as healthcare move in this direction?

According to Zelis, personalization should be looked at in two ways: on a community and an individual level. She shared a recent example of community customization at the University Hospitals of Cleveland. “My team was working on a center for women and children in an area with a high infant mortality rate. We discovered that the neighborhood was a food desert, so we partnered with a local grocery store before we built the clinic,” she said. “Healthcare providers are going to continue to change how we deliver care in different settings to align with true community needs.”

Zelis shared that there will always be a need for brick-and-mortar facilities, but that there’s great potential for personalization in the telehealth arena. “We need to be able to mass customize a personal experience that aligns with technology. How many of us carry a paper boarding pass into an airport? The same thing needs to happen in healthcare. Our job is to provide a virtual experience for patients from the comfort of their home.”
THE POTENTIAL OF IoT

According to Weldy, a conversation about technology in healthcare would be incomplete with mention of the Internet of Things (IoT), the billion-dollar industry poised to transform business and healthcare. Participants agreed that IoT will have an extremely significant impact on facilities operations and management.

An audience member from a Florida hospital system shared that IoT has been helpful in mitigating the risk of water damage during hurricanes: “We’ve had great results from installing sensors into wall cavities to monitor and identify breaches in the system.”

Edwards agreed that leveraging sensors to better support healthcare buildings is the future, and has many applications, such as tracking and optimizing space utilization.

IoT’s application regarding infection control was also discussed; mainly, the fact that IoT can offer a preventative solution to the issue.

“With sensors, facilities leaders can monitor real-time pressure in rooms and other factors that contribute to infection transfer,” said Weldy.

Zelis believes the predictive analytics that is already prevalent on the clinician side will also become essential to prioritize the biggest risks for facilities. “We’ll see a transition to outpatient facilities that have sicker and more complex patients, whereas hospitals will be more like high-level ICUs. I believe we’ll apply lessons from the inpatient world to the outpatient world.”
RISING COSTS

Wrapping up the discussion, Weldy surveyed the room on the topic of cost escalation. The majority of audience members confirmed that they were experiencing extreme cost increases, attributed to a combination of factors: a shrinking labor pool, reduced subcontractor options, and market conditions.

Zelis believes the industry is “in a time of chaos” due to multiple elements that are moving in parallel and slowing down the velocity of change. “Regulatory controls, HIPPA, payment models that aren’t aligned with innovation, consumer expectations...all of these pillars are on different paths at the moment. We need them to align and move together to see real change. We can’t fast-track to quick virtual visits if we don’t have the technology or the ability to get reimbursed.”

Edwards echoed the same point of view: “The industry’s slow-moving crawl in the innovation department has to do with its complexity. With so many components and specializations, anyone change affects 15 different departments and getting the whole system aligned takes a lot of time. I do believe, however, that we are learning how to more rapidly create a prototype and spread change faster.”

Brad Lahr has noticed a shift in the “innovation mentality” as well. At Mayo Clinic, his team is in the process of planning for an economic initiative called Discovery Square, an addition of 2 million square feet for research and development that brings together physicians, scientists, tech entrepreneurs, and more to advance patient care.

“Instead of researchers developing an idea and then bringing it to clinicians, they’re first coming to clinicians and saying: What do you need to solve? There’s a definite change in approach.”

Despite the hurdles to overcome, one thing is clear: healthcare facilities and real estate leaders aren’t standing still in today’s rapidly changing environment. Major players are capitalizing on new opportunities and breaking down silos to deliver innovative solutions to the industry’s greatest challenges.
A CEO’S PERSPECTIVE ON HOW TO PREPARE FOR DISRUPTION

Larry Antonucci, MD is CEO of Lee Health, the third largest nonprofit public health system in the country. At HealthSpaces ’18 he gave a far-reaching presentation that looked at the current state of healthcare in terms of trends, technology, and leadership; how disruptive changes in the healthcare industry could affect facilities leaders; and what they can do to prepare for it.

Dr. Antonucci identified five key areas that trends in healthcare are currently disrupting and addressed them one by one:

• The payer market
• Care delivery
• Consumerism
• Competition
• Consolidation and scale
CARE DELIVERY SHIFTS FROM VOLUME TO VALUE

In care delivery, the second key area Antonucci identified, a dramatic shift is happening with physicians. For the first time ever, the majority of physicians do not have an ownership interest in their practices. Moreover, physician compensation is shifting from volume to value.

“That has been a tricky transition,” he said. “We really need to help them understand they can succeed in a value-based world; it’s just different.”

While the coming years will bring a physician shortage, many states are allowing non-physician providers (such as nurse practitioners) to take on more physician responsibilities. Advances in artificial intelligence and genomics for precision medicine will centralize routine diagnostic functions so they’re not one-size-fits-all. While digital care is still in its infancy, one-third of ambulatory and 80% of behavioral visits can be addressed through telehealth.

For example, the Kardia app pairs with a $99 device that is installed on the back of a person’s phone and records a medical EKG that the person can send to his or her physician for near-immediate review, rather than waiting weeks for an appointment and undergoing a barrage of tests with expensive medical equipment. So now the same diagnostic measure that would cost $3,000–5,000 (not to mention weeks of precious time) is now only $99.

THE PAYER MARKET REFUSES TO PAY

First the payer market: Market transformation means revenue pressure for health systems. As it stands, the largest insurer in each market holds an overwhelming majority of the market share in each state for the majority of states. High-deductible health plan enrollment is on the rise, now up to 43% of all those insured. Government payers are also on the rise with enrollment in Medicare and Medicaid plans increasing, and both governmental and commercial payers are getting tougher on high hospital prices. While some would point to the “overuse” of hospitals and emergency rooms as the reason for these high costs, Antonucci said the problem really is that American hospitals just charge much more for services that are cheaper in other countries, and now insurers are starting to refuse to pay for certain services.

“The shift to value is continuing but it’s unpredictable,” he said. Provider-sponsored health plans and direct contracting are new models that are emerging, but so far they have had mixed success. Provider-sponsored health plans have struggled to become profitable, and several have already sold or gone out of business since 2010. Direct contracting seems to have more promise—with three percent of employers currently utilizing this method but 26% saying they are considering it—but this system still needs to build the expertise to manage claims and care.
Telehealth solutions also show great promise for behavioral health treatment, which is a huge gap in the care continuum as patients with behavioral health conditions use more medical resources and behavioral healthcare providers are not well integrated into the health system.

THE CUSTOMER-PATIENT IS ALWAYS RIGHT

The third key area that signals a big change in healthcare is the concept of consumerism: Consumer expectations are changing, and providers are struggling to keep up.

“Patients have to pay out of pocket much more than before so they are shopping around,” Antonucci explained. “Millenials are now a larger cohort than Baby Boomers and they think and act differently. Their expectations are quite different.”

“Millenials have been ‘primed’ by Amazon and Uber reducing friction in the service space, which is what they’re used to.”

Three-quarters of Millennials will check online reviews when shopping around for a service provider, and as many want to see a doctor virtually, which is a drastic departure from Baby Boomers. Most want to be able to book appointments through mobile apps, and one-third have downloaded a health app in the last 30 days.

And yet hospitals are still lagging behind, operating very much in analog still. Only one in five health systems have an online price estimation tool—meaning:

- Only 20% of hospitals can give patients any idea in advance of what something might cost them
- Only 14% offer digital tools and information to enable customer engagement
- Only 23% offer a range of virtual and telehealth access points
- and only 43% provide messaging between patients and providers

“There is still a significant gap in what consumers want compared to the capability to deliver that,” said Antonucci.

He outlined a “growth roadmap” for health systems to become more competitive as consumerism comes to dominate the healthcare industry. To attract and retain customers, healthcare systems must improve access (including things like 24/7 on-demand access via mobile devices) address pricing transparency and reposition “shoppable” services, build loyalty to retain customers by focusing on the customer experience, all while ensuring the foundation (including leadership and branding) remains solid.
NEW COMPETITORS EMERGE

The fourth major disruptor category in the healthcare industry is made of the disruptors: new competitors that are changing the healthcare ecosystem. Competitors are creating new business models that do not include hospitals, focusing instead on the outpatient and post-acute care that has the biggest profits. At the same time, pharmacies are becoming multi-service health centers and retail clinics and urgent care facilities are receiving huge amounts of venture capital investment. Tech giants like Apple and Amazon are also getting into the healthcare space, and they will find the solutions that hospitals have been too slow to adopt.

“Healthcare is going to look a lot different in five years. We’re not going to see the same things we’ve seen for decades and decades.”

HEALTHCARE LOOKS MORE CORPORATE

Finally, we have the mega-mergers and billion-dollar acquisitions. Providers are seeking unprecedented levels of scale, and that necessity of scale has led to mergers of equals, enabling these newly-merged companies to enhance their brands, expand their geographic reach, build negotiation leverage, add and enhance competencies, drive efficiencies, and improve access to capital. But even the largest providers to emerge from these mergers are still far smaller than new and potential competitors from the likes of Apple, Amazon, CVS, and Walmart.

“What has happened so far is not even close to what’s happening on the other side of the corporate world and the change that could mean for healthcare,” said Antonucci.

The implications for today’s health systems are easy to see, though perhaps harder for an industry that has spent decades doing business as usual. To compete in the Internet economy, health systems need to adopt the strategies of the Internet economy.
SO WHAT’S A HEALTHCARE SYSTEM TO DO?

First, perfect the product. Health systems need to work continuously to perfect their product just like the “Big Four” do (Apple, Amazon, Facebook, and Google). Focus on a few things, the can’t-fails, and do them really well. For too long in the healthcare industry, the focus has been on making products that can get reimbursed through insurance companies and not on making great products. Now is the time to change how health systems view healthcare delivery.

Second, health systems need to get serious about costs. The Big Four relentlessly pursue the lowest possible costs. As it is now, healthcare costs are unsustainable—healthcare spending is currently 18% of the national GDP. Average premiums have raised 134% for employers and 167% for workers over the last 15 years. At the same time, operating revenue is falling while operating expenses are rising.

“We need to deliver a platform for a more affordable healthcare system or face major social, political, and economic problems,” Antonucci warned.

The third major thing health systems need to do is remove friction—the parts of the experience that create even minor inconvenience. For the Big Four, that means fewer clicks, faster search results, easier payment, and faster delivery. For health systems, it means ease of appointment scheduling, reducing wait times, improving communication with and among providers, reducing repetitive paperwork and confusing billing, and increase digital options for care and communication. Relentlessly pursuing the reduction of frictions will also aid in building customer loyalty.

Finally, health systems must “control the last mile.” The “last mile” is all about the customer experience, and that is what companies like Amazon and Uber excel at—taking experiences that weren’t even perceived as problematic, like shopping or hailing a cab, and making them seamlessly convenient.

“Healthcare’s last mile is the least convenient and least appealing of any industry, and that’s our greatest vulnerability,” said Antonucci. “We have got to find a way to make that last mile not a chore, but an experience. Whether we are willing to try it or not, we are going to be forced to if we want to stay in the healthcare business. Facility experts need to be thinking about how this will all work together.”
**HOW MODULAR CONSTRUCTION IS TRANSFORMING HEALTHCARE**

**Chris Giattina**, the CEO of BLOX, has built a company around the idea of constructing medical facilities that can be easily adapted to changing needs, a concept he shared at HealthSpaces.

**DESIGN MANUFACTURE CONSTRUCT**

“BLOX created a building delivery method called “Design Manufacture Construct“ (DMC) - simply, we are teaching a legion of architects how to leverage manufacturing productivity so that construction is simplified. When we can make construction simple, we approach our goal - to make buildings with twice the quality at twice the speed with twice the value - 2x2x2,” Giattina said. “If we can do that, we’ll make a difference.”

“We’ve focused on healthcare construction because of the opportunity to create repeatable, standard solutions for serial builders of healthcare. Today, we are working with healthcare companies across the US.”

First, some background: around 2000, Honda asked Giattina to lead design and construction of a massive project in Alabama – they wanted the first phase opened nine months from that very first conversation. They made all of the company’s resources available to him, and six weeks later they broke ground on a 1,000-acre site.

“By that sixth week it was abundantly clear that unlike the Japanese automotive industry, the American construction industry had failed to invest in the R&D that would allow them to deliver quality at speed,” Giattina said, “so all we had was brute-force. We finished, but it was painful and unsustainable. We knew we needed a better process.”

From that project, a group of architects, builders, and engineers got together and began to develop a framework to fix the issues of the industry. They defined their goal as 2x2x2 - they’d make twice the quality with twice the speed for twice the value. “If we could do that, we thought, we would be valuable in a world of clutter,” he said.
STEP ONE: STANDARDIZATION

Giattina presented a case study showing how the nation’s largest for-profit hospital company used DMC to standardize its major building components across its diverse and complex portfolio. The outcome was a set of standard modules that could be used on all projects across the US. It was not just a design standard, but a complex manufacturable standard that had supply chain intelligence combined with regulatory and cost controls built-in. The cost per part dropped, but the overall cost of the building was unchanged. The early promise of cost reduction at the part level led them to focus on how to make that promise enure to the overall benefit of a lower building cost – Step Two.

STEP TWO: OPTIMIZATION

In DMC step one, BLOX was making individual modules that worked with traditional construction. In step two, they wanted to take the building in “chunks” – large structural building components that fit together in the field like giant legos to make buildings.

The “legos” are based on a structural 15x15x60’ “Uber module” – a universal structural steel frame that can be stacked 30 stories high. That universal frame can contain a lot of complexity and any number of different modules—X-Ray, CT, patient rooms, Central energy plant, Trauma, labs, cafeterias— all fitting into the Uber Module.
In addition to the Uber Modules, BLOX used technology to skip some of the normal industry processes and was able to go from building information model straight to building fabrication. This improvement came from using a cloud-based platform called WEVR. The software takes raw materials and organizes them with manufacturing and regulatory constraints, then finds the best-in-class manufacturers and makes standard products which are distributed through a web portal. This process utilizes technology that previously hadn’t been used by the industry and it has helped scale DMC so that costs can drop.

Throughout step two, Giattina tracked the improvements to the ideas of DMC across a fifteen project case study of Free-Standing Emergency Departments. After completing the first five projects, BLOX saw significant gains in design and manufacturing from project one to five: design time went from over a year to 45 days; manufacturing time went from 100 days to 25 days. Importantly, construction time did not improve from project one to project five (even though the building was being delivered at twice the speed of traditional construction).

Because construction was still the constraint, other items were subordinated to allow a solution to construction to be the focus. BLOX took a two-pronged approach: they used design to take more complexity out of the field; and they worked to improve their construction techniques on those conditions that could never be removed from the field. In a continuous improvement cycle, BLOX repeats this process in five project groups while measuring the results before making the next set of improvements.

“When we finally get to 2x2x2 at scale, we will have unraveled the Gordian knot of higher quality at a faster rate and a lower cost,” Giattina said, “We aren’t there yet, but we are gaining on it.”
Reducing Energy While Adding Space

Children’s Hospital of Philadelphia has managed to do the seemingly impossible: reduce energy use and cost while also adding space. Douglas Carney, AIA, Senior Vice President for Facilities, Real Estate & Capital Programs at CHOP, explained how that was even possible at HealthSpaces.

As one of the top pediatric hospitals in the country as well as one of the oldest, with a history dating back to before the Civil War, the main mission of CHOP is restoring kids to good health. The hospital has 562 beds and over 5 million square feet of real estate, and being able to add space while also reducing energy use and cost helps them to further serve their main mission.

Carney highlighted two case studies that allowed them to do just that.

“We’re showing engineering magic in these cases,” he said. “They’re also good examples of good stewardship of both the environment and our resources. As an academic medical center with the same tri-part mission as other academic research centers, in a good market our research and teaching components are not subsidized so the more we can husband our resources the better we are able to support our mission.”

From 2009 until now, CHOP’s overall energy costs have been reduced by $1 million per year. During that same time period, the hospital has nearly doubled its space, from roughly 3 to 5 million gross square feet.
He acknowledged that part of that savings came from a reduction in natural gas prices that started in 2009, but stated that about half of that overall savings came from those two projects. The fact remains, he said, that “while adding substantial square footage, our energy costs went down.”

**THE MAD SCIENTIST HATCHES HER PLANS**

The first project was a chiller/heater. Carney said his “mad scientist”—CHOP’s Senior Director of Building Systems, Operations and Refrigeration Rachel McCarthy, PE,—wanted to see if the technology used to allow ski resorts to create snow in the desert of Dubai was something they could adapt for the hospital and if doing so would be worthwhile.

The answer was a resounding yes, and the machine they built to do so was the first one of its kind. It has a 175% efficiency rate, cost $1 million with an estimated one-year payback (which became a two-and-a-half-to-three-year payback after energy costs went down again).

“It has saved the equivalent of 5,867 tons of carbon dioxide emissions, 497,223 gallons of gasoline, and 3,635 acres of U.S. forest per year.”

The second project is the optisine story: the “mad scientist” McCarthy wanted to put a photovoltaic (PV) array on the top of CHOP’s buildings, just want to see what happens—a legitimate reason to do things at an academic center. She thought it could convert DC power to AC power and wondered what would happen if the hospital put that on their primary incoming feeds downstream of the electric meter. The answer was that energy costs could be reduced by a solid and stable 17 percent or $2 million per year.

**THE RESULTS? WIN-WIN-WIN**

The most obvious and immediate benefit here is the cost savings, as Carney pointed out. But beyond those money savings, these two major improvements have also allowed CHOP to be a good steward of the environment and reduce air pollution in significant ways. In Pennsylvania, he said, 53 percent of the electricity used comes from coal-fired plants in Western Pennsylvania, all of which send particulates into the air that contribute to acid rain—which is damaging to lungs.

“We do this to save money and be good stewards of the environment, but we also do it for the kids, especially kids with really bad childhood asthma,” said Carney. “One common problem we treat at the hospital is chronic childhood asthma. So by doing this we are reducing the triggers for childhood asthma we release into the atmosphere in West Philadelphia and that perfectly aligns with our mission.”
A conversation about the future of smart buildings and IoT in healthcare is all but impossible without discussing Bluetooth.

The technology has experienced drastic growth within the past few years, especially with the advent of Bluetooth mesh networking, which arrived on the scene in July 2017. Mesh networking is just one of the recent advancements expanding the definition of the smart building and providing global interoperability for the IoT, which has huge implications for healthcare facilities leaders.
At HealthSpaces, Jim Katsandres, director of developer relations and evangelism at Bluetooth Special Interest Group (SIG), shared how Bluetooth is working to make intelligent building monitoring and automation at scale a reality, especially in commercial and industrial environments, where reliability and security requirements are non-negotiable.

THE EXPANDING ROLE OF BLUETOOTH

First, Katsandres shared some background information about Bluetooth SIG, which is a nonprofit standards body. With over 35,000 member companies responsible for officially creating all the Bluetooth devices in the world, Bluetooth SIG has experienced remarkable growth—to a tune of 90%—since 2012. That number is expected to double in the next five years.

“In 2018, our member companies shipped out about 3.9 billion shipments,” Katsandres shared. “Bluetooth is not just in the consumer space, but also manufacturing, smart buildings, airports, hearing aids, home automation products and so much more.”

Katsandres shared that there are now four common connection types for Bluetooth low energy (LE):

1. **Audio Streaming (point-to-point)**: wireless headsets, wireless speakers, in-car infotainment
2. **Data transfer (point-to-point)**: sports and fitness devices, health and wellness devices, peripherals and accessories
3. **Location (broadcasting)**: point-of-interest information, navigation and wayfinding, item and asset tracking
4. **Device network (mesh)**: control systems, monitoring systems, automation systems
"In 2018, our member companies shipped out about 3.9 billion shipments." Katsandres went on to specifically explore the two newest types: location services and mesh networking. He shared that retail and healthcare are stepping up as early adopters of Bluetooth’s latest smart building technologies and that 100 million Bluetooth smart healthcare devices are predicted to ship by 2022.

When it comes to industrial spaces, where it’s a more demanding environment for radio communication, Katsandres shared an example of the benefits of smart technology. “When ABB Group, a leading industrial technology provider, added wireless sensors onto their motors, they were able to reduce unplanned downtime by up to 70% and extend motor lifetime by 70%. Energy efficiency also improved by up to 10%,” he said. “That’s the power of predictive analytics.”

**THE RISE OF LOCATION SERVICES**

What do hospitals, stadiums, and airports have in common? According to Katsandres, they’re increasingly embracing location services to create a more seamless customer experience. He shared that location services are gaining significant traction, with benefits that include:

- Point of interest information to enhance the visitor experience
- Indoor navigation to assist with wayfinding and overcome indoor coverage challenges that GPS can’t address
- Asset and item tracking, from inexpensive personal item tracking solutions to large-scale asset tracking solutions found in hospitals and factory floors
- Space utilization to enable building owners to better understand how space is being used
Another example of Bluetooth’s expanding role in the smart building space is in the area of security. Katsandres shared that many wireless carriers, such as Verizon and AT&T, are working with buildings to register their beacons. “If you were to call 911 inside a burning building, the beacons in your location of the cell phone inside the building is transmitted to 911 operators. This can provide crucial information about where to find you in potential emergencies,” he said.

THE BENEFITS OF MESH NETWORKING

Mesh networking is the newest typology from Bluetooth, and enables many-to-many device communications. It’s optimized for creating large-scale device networks, which is part of its appeal for health systems and hospitals.

When it comes to building automation, sensor networks, and IoT solutions, mesh networking offers reliability and security for thousands of devices to “talk through each other.” Bluetooth mesh is one of the fastest-growing typologies in the organization’s history and is being adopted into control systems, HVAC systems, and automation systems.

Katsandres broke down the basics: “A mesh network is made up of nodes, so each light could be a mesh node. Say you have a wall switch on the wall; when you turn it on, it sends the Bluetooth signal for hundreds of feet. The switch publishes that message and the lights listen to it. It can turn on thousands of lights, from entire stadiums to campuses, with no router.

“There are a lot of extra services you can add and access within one device.”

It also does so with zero perceptible delay, meaning the result is instantaneous rather than a “popcorn effect.” Another advantage of having no routers is that there’s no point of failure. Even having a hub or internet connection is optional as well. Because the actual advanced control lighting system is in each light in the Bluetooth chip, your lighting control system still works even when the Internet is down.

“There are a lot of extra services you can add and access within one device. Just some of the applications we could run on the Bluetooth for a lighting system include advanced lighting control, location and wayfinding, asset tracking, and space utilization,” he said.
A FEW MORE BENEFITS REGARDING MESH SOLUTIONS:

- Inexpensive sensors allow for more things to be monitored and controlled. *Ex.* sensors in every light, conference room, chair, etc.
- Standardization provides the opportunity to eliminate duplicate sensors (*occupancy sensor for lighting, HVAC, space utilization, etc.*)
- Sensors are migrating from being retrofit to built-in
- Installing and removing wires is costly and sometimes dangerous
- Sensors can be used for safety enhancement (*changing environmental regulations and health, gunshot detection, emergency alerting*)
- Bluetooth LE allows batteries to be smaller and last longer, or not be needed at all

THE FUTURE

At the end of the day, Katsandres believes that security and trust is the reason Bluetooth is embraced by commercial and industrial companies.

“If you’re going to use a sensor inside a valuable piece of equipment, you want a technology that’s going to be around and work in 30 years. We can promise that because our members own all the technology,” he said. “Bluetooth has multiple levels of security. Mesh protects at the device layer and network layer, and each application that runs on the network uses separate state-of-the-art encryption.”
Walter Jones, the Senior Vice President of Campus Transformation for Cleveland’s MetroHealth System, is currently overseeing a three-million-square-foot, $1 billion project that started in 2012 and won’t be completed until 2022. That’s 10 years of planning and construction from start to finish.

Maybe 10 years sounds like a long time or maybe it doesn’t, but consider this: 10 years ago today, smartphones were only just starting to infiltrate the mobile marketplace. We didn’t have drones. We didn’t have 3D printing. We didn’t have tablets, or home assistants, or ridesharing, or consumer VR. Electric cars were still a novelty and road-worthy autonomous vehicles didn’t yet exist.

So, a lot can happen in a decade, especially in this age of technology advancing faster than the consumer market can keep up with it. And yet to build a large complex like a hospital, it still takes 10 years from the very first conversation to get it done.
THE TEN-YEAR ITCH

Jones outlined his somewhat impossible task of planning and designing a building that won’t be completed for 10 years—long after most of the people involved in those first conversations have since moved on to other things—in a recent talk at HealthSpaces.

“When an organization has decided to undertake change that includes a monumental capital project, it has chosen the lengthiest, most costly way to do so,” says Jones. “A new campus is the longest part of that whole effort.”

And not only does a project of this size take a decade to complete; it also has to be perfect, both in the eyes of the people who first approved it and those set to use it in 10 years’ time.

Jones isn’t new to this process: He previously oversaw the $1.3 billion new Parkland Hospital in Dallas, the largest public hospital project in the U.S. While the actual construction itself took five years, discussions about this new hospital started as far back as 1998. The hospital didn’t open until 2015. The whole process involved over 700 touch points of stakeholder input from well-respected, professionally awarded staff members to develop the programming and design of the building.

“By the time that project was finished, over half the stakeholders did not see the project to completion,” Jones states. “Directors and senior executive staff, the entire C-Suite of the organization, and half the board were lost during the design and construction. We were essentially informed by ‘ghosts’ for others to inherit.”
One example he highlights is a vision statement for the building that was written in 2007: By the time the job was completed, there was a second interim CEO in place who pointed out to Jones that the building doesn’t do what was written in the vision statement. And yet, Jones says, it was a very successful project that yielded a 10 percent increase in volume the first year it was open.

“So why did I need to talk to all those people? It seemed kind of pointless.”

He further points out that he spoke to a LOT of people during that time but used at most maybe 10 percent of the input he received. “So again,” he asks, “how much of that mattered?”

His solution? When undertaking a project of this size and scope, you have to allow for change in a neutral environment. You can’t predict anything, it’s hard to say if what’s important today will still be important 10 years from now, and most of the people you’re talking to now will disappear by the time the project is complete. You have to design a building where it doesn’t matter what the technology will be or what people today believe will be its primary purpose. You have to provide the capacity for anything and everything.”

A HOSPITAL THAT FUNCTIONS LIKE A CONVENTION CENTER

“Think of it as open source or as an open warehouse—a big empty building where you can put things in and take things out any time, but the basic structure doesn't need to change,” he advises. It should function like a department store where the displays are moved around, or an open office building where the cubicles and desks can be rearranged, or a convention center and event space that can be used for multiple purposes.

“The basic structure doesn’t need to change. How about creating a hospital that works just like that?”

With his current project, he notes that in the last four years at MetroHealth there have been on average 100 new staff members coming in per month and 70 leaving. By the time the project is complete, he says, “We will have nearly the entire complement of the total occupancy of the main campus of the hospital replaced in the organization in that time. I can't keep changing the design because I keep changing where the input is coming from, so I need a facility that is stable enough to accommodate that. I need to separate the operation from the experience.”
Because most of the staff members who supplied the initial inputs will be gone by the time the project is done and replaced with new staff members who will have inputs of their own, Jones sees the essential part of his role as focusing on what really matters. He considers elements that are standardized, fixed, moveable, and adaptable: Acuity adaptable standardized rooms that can serve more than one function. Prefabricated rooms that can get to market quicker. Sufficient connections for IT density without having to predict what the technology will be. A facility that is more assembled than constructed, bringing the parts and pieces together rather than building on-site.

**WHAT REALLY MATTERS: THE PATIENTS**

“We’re changing from an operational method to an experiential method because the one thing that is consistent is the patient experience,” he says. “That is the most stable driver. They still want the same thing as they did 10 years ago: comfort, privacy, quiet, and respect. We want to focus on the patient experience and let everything else feed into that, from the logistics to the personnel factors.”

In order to do this, his team is also sourcing a “patient and family advisory committee” as their primary driver because the things they care about the most, and that the building design should most consider, are going to be the same.

With this in mind, they have a charter: “The MetroHealth campus transformation will create an environment that supports MetroHealth’s mission of ‘Leading the way to a healthier you and a healthier community’ by promoting community engagement and excellence in care delivery, research and education resulting in improved health and wellness.” As Jones states, this is a mission that won’t be obsolete in four years.

“We’re focusing on the patient journey. We know what our patients are looking for,” he says. They started at the master plan level creating a hospital in an open park that will be an anchor institution on the west side of Cleveland. Half of the 52 acres that the hospital sits on will be converted into open green space, fulfilling a great need for green space in that area. Six acres will be an open park inviting the community in, and the hospital itself is designed with the park in mind, granting scenic views and visual access to nature. The design of the typical floor is repeatable and any room can be made into anything at any time, removing and adding partitions as needed so that a standard patient room can become an ICU room if they need to surge up in the event of an emergency.

“The idea is that it’s a process-neutral design,” he concludes. “I don’t have to worry about your operations. It doesn’t matter. I don’t care. I have an environment that can support just about anything that you want to do. I don’t have to worry about the technology you want to run across because I’m going to put the infrastructure and wires in so it doesn’t matter, I don’t care, I don’t have to have that conversation.”
STRENGTHENING COMMUNITY ENGAGEMENT FOR BETTER BUILDING OUTCOMES

The Erlanger Health System in Chattanooga, Tennessee has a brand-new outpatient facility, the Children’s Hospital at Erlanger Kennedy Outpatient Center. And just as it takes a village to raise a child, it took a community to raise this pediatric center.

Don Mueller, CEO at Children’s Hospital at Erlanger, explained how they were able to make this dream a reality at HealthSpaces.

Everyone thought they were crazy: in 2015, Erlanger was the country’s seventh-largest public hospital system and received very little—if any—philanthropic support. So when the idea of building a new outpatient pediatric center was raised that year, no one thought it would happen.
But they persisted. Under the new leadership of CEO and President Kevin Spiegel, Erlanger grew from $600 million to $1.2 billion from 2013-2018, doubling in a flat market. And through a fundraising strategy that emphasized community engagement, the hospital system was able to raise the $42 million for the new outpatient facility—starting from absolute 0—and get it open to the public in less than four years.

A SIMPLE FIVE-POINT PLAN

As Mueller explained, they came up with a simple strategy to make this new outpatient center a reality and outlined it in five points: first, select the right team. Second, develop a “Vision and Guiding Principles” statement. Third, benchmark with the best. Fourth, engage the entire community and create something unique. And, finally, celebrate your successes and enjoy the process.

Before they selected their building partners, they put out a request for proposals for design and construction, screened 25 of the top-qualified firms in the United States, and then told those firms partner up and come up with something. The design and construction teams came together and spent several days in Chattanooga, while Erlanger staff also visited them in their respective offices.

“We were really looking for a cultural fit,” Mueller said of the design and construction teams, so it was important to them that everyone—architects, builders, and Erlanger staff—spent time together and got to know each other. The teams developed their ideas, Erlanger narrowed it down to their top two choices, and those teams presented their concepts in IMAX to the whole city of Chattanooga to help the hospital get buy-in from the local community.

“We needed to raise $40 million to build this building that was nothing but a dream, so we had to get the community involved,” said Mueller. “We had to raise excitement in the community. People were skeptical but they got engaged through this event.”

Erlanger developed their guiding principles with input from their own medical staff and people in the community. Mueller said that they didn’t want to just do an actuarial analysis; they wanted to build something unique to Chattanooga and also make it universally appealing. Because they treat children all the way up to age 21, they didn’t want it to just be a little kid’s hospital full of cartoons—they wanted it to also appeal to an 18-year-olds coming in with football injuries.
In terms of design, they wanted it to be a place full of “discovery zones” instead of waiting rooms so that people could be engaged and learn instead of just sitting and waiting. Chattanooga is known as an outdoor lover’s paradise—Outside Magazine named it one of the best towns to live in the U.S. twice—so they wanted to incorporate architectural and landscaping features that reflected the natural environment of southeastern Tennessee.

They visited other children’s hospitals across the country as part of their “benchmarking” and asked them about the best things they’ve done as well as their biggest mistakes and failures. “The coolest thing about children’s hospitals is that we tell each other these things,” Mueller said. “There’s no such thing as competition when you’re dealing with sick kids.”

The resulting design is a culmination of several different inputs. This includes shared everything—no longer would one department be in desperate need of beds while another sat half-empty—including waiting areas, flexible treatment rooms and clinic pods, and identical exam rooms that can be used for any purpose, adding 30 percent more capacity through these shared spaces. They also eliminated private offices for the doctors—a cultural transformation that took strong leadership and continued engagement to get staff to support. This decision enabled them to build 72 exam rooms instead of just 40.

Because they were building 72 exam rooms they wanted to make sure they got them right, so they held three stage mockups for doctors, nurses, friends and family, and other stakeholders to give their input. They also led hardhat tours for stakeholders every week throughout the whole construction process.

“The mock-ups were used as a way to get the community engaged,” he said. “We built a mock exam room and took it on our road show and even had it at our big gala. We had a donor community that’s never been involved with us at a gala we’ve never had before and we were showing them how we’re going to transform pediatric healthcare.”

But the community also needed to see, understand, and get excited about their vision of healthcare transformation. In order to do that, they needed to do something to spark that excitement and create something unique for the community. So they visited one of Chattanooga’s most iconic family attractions: the Tennessee Valley Railroad Museum. And they asked the folks at the museum, “How do we get people excited?”

As it turns out, having a train certainly helps. They were able to work with the museum to get a steam train that was built in 1891 on permanent loan, and that is now the signature feature of the building. When people pull up to the main entrance, they’re not pulling up to a hospital: They’re pulling up to a train station.
Additionally, the famous outdoor Chattanooga attraction known as Rock City funded a “secret garden” on an outdoor patio, there is a hang glider suspended from the ceiling in the lobby (paying homage to Chattanooga’s status as one of the top hang-gliding destinations in the country), and Erlanger worked with the local fire department to bring a fire truck cab into the building.

“[W]e need these kids distracted. [W]e need them ready to be able to engage with the doctors or nurses and not be scared,” Mueller stated. “If you get dropped off at a medical office building you’re not in a good spot, but if you get dropped off at a train station or get to play in a fire truck, you’re much more ready to talk to the doctors.”

And it’s not just about having cool stuff for the kids: Getting involved with these community partners also increased community buy-in. The fire department helped the hospital in their fundraising efforts, which helped get the community excited and build momentum. The day the 80-ton train was moved across town to be placed at the hospital was another big community engagement day.

The center became such a community passion that even the construction team hired to build it went out and did fundraisers of their own, writing a check to the hospital for $24,000. In total, over 6,000 people wrote checks to support this project and raised $42 million to see it completed, and that was absolutely because of Erlanger’s level of community engagement—certainly a success they can celebrate.

“The most important thing was to get the feedback from the community and figure out how we could make this something really special for the community. We’re trying to do something that’s going to impact our city for years to come,” said Mueller.

“It’s not just about building a building: It’s about transforming the way we deliver care.”
“Physician burnout is a very real thing and some of us see it up close and personal on a regular basis,” Niraj Dangoria, Associate Dean of Facilities Planning and Management at Stanford University School of Medicine, began his recent talk at HealthSpaces. In fact, he noted, 54% of physicians report experiencing at least one symptom of burnout and 40% work 60 hours or more per week.

Stanford has been active in addressing this crisis. A few years ago they created an Office of Physical Wellness, WellMD, with the understanding that doctors who take care of themselves do better with their patients. The work they do really affects their well-being, and in turn, it affects the care they give to others.
DESIGNING FOR WELL-BEING

Some of the questions they asked as part of the overall WellMD effort were, “Can the physical environment or workplace enhance the physicians’ well-being? And if so, how?” It was with these very questions in mind that Stanford’s new Center for Academic Medicine (CAM) was designed.

Dangoria explained that physicians come to Stanford because they have a chance to engage in clinical research. Otherwise, they would make more money in private practice. Because of this, there is a distinct difference between the public and private sides of their professional lives, with the private side being their intellectual pursuits. How, then, can Stanford engage them in those intellectual pursuits?

One obvious solution would be to put private offices for the physicians in the hospitals, but hospitals hate that—that kind of dedicated office space is very expensive in a medical building, and then there is no separation between the physicians’ public and private professional lives.

Stanford conducted several different types of surveys over six months, asking physicians what the most important attributes in their workplaces are. They found that the top priorities included comfort, quiet, light, parking, proximity, technology, and flow.

Through focus group interviews on user experience, Stanford concluded that the physician’s workplace needs to support individual faculty in their clinical work as well as encourage collaboration; have some access to nature; connect to natural elements and allow for acoustic control; allow for a flow of interaction between faculty, staff, across departments and connect to the hospital; and support seamless, flexible, mobile technology.

In designing and constructing a brand-new building with a focus on physician well-being, Dangoria said they knew they had to create spaces that fundamentally support physicians’ programs and activities as well as their intellectual pursuits, are quiet and comfort, and have flow and light.

Essential services include a café, break rooms and lounges, and plenty of outdoor space to interact with the natural environment. Essential spaces are private workspaces, meeting rooms, and small group spaces for collaboration. Physicians also preferred a comfortable, almost residential design—“resimmercial,” as Dangoria called it.

“For this building to be successful, users have to be satisfied,” he said. “They have to feel better when they leave than when they arrived. Our criteria for success are user satisfaction, workplace performance, and improved well-being. The vision is rejuvenation.”

They also envisioned a fully “concierged” building—one in which physicians can get what they need when they need it, where people and technology are synchronized in everything from scheduling to deliveries—and this service platform has live support all hours the building is open.
“We’re building an Apple Genius Bar-type space where on-demand services are readily available,” said Dangoria. “We really want to serve our faculty in ways we haven't before.”

A BUILDING THAT CAN ADAPT TO CHANGING NEEDS

He further explained that for a building to work with such a continuously evolving paradigm, they had to create architecture that is adaptable and that can respond to changing needs as they evolve. So walls can be moved, small private offices can become larger shared offices, shared offices can be opened up and become common areas, office space can be transformed into meeting room space, and so on. Similarly, the furniture is also modular and interchangeable to allow further adaptability of different spaces.

There are still private offices in this building because they found the need for private office space is still very much alive despite the trend towards open, collaborative workspaces without walls. But only faculty members who spend more than 50 percent of their time on research get private offices; Dangoria himself sits in a cube out in the open with his fellow staff. There are also plenty of other different kinds of workspaces, including collaborative areas, all designed for multiple user types.

The site of this new building borders a 1,000-acre arboretum. Natural materials were used throughout the building so that the connection to nature is always close at hand, and there is natural light everywhere in the building. Offices are perpendicular to the wall so everyone shares the natural light. An 800-car underground garage connects to the café, which has a teaching kitchen that can teach faculty and staff about cooking and eating healthy. There is a gym on-site that overlooks the arboretum and adjacent childcare area. Community spaces also look out over the arboretum.

“We’re trying to develop a building that gives them everything they need in their personal lives on a day-to-day basis,” said Dangoria. If this design experiment of Stanford’s is able to accomplish even half of what it is trying to achieve, it could completely change the workplace paradigm for physicians, improving their overall well-being as well as improving the patient experience.
If you take nothing else away from the talk given by Dr. Whitney Austin Gray, Senior Vice President of Delos, at HealthSpaces, then know this: Humanity has been challenged to adapt to our modern way of working where we spend 90% of our time indoors, and an average of 90,000 hours of our life at work. Although we have protected ourselves from the more obvious threats of malnourishment, food allocation, predators, and infectious disease, we are now faced with the less obvious threats of stress and burnout. In this way, we have maladapted to our modern environments with mental well-being as a leading indicator. In other words, our nation is not well.

Dr. Gray was specifically talking about wellness of the mind, a critical component of overall wellness that is often overlooked when other physical measures of wellness can be neatly checked off a list.

Specifically, she is referring to stress, the silent killer. She tells the story of “Sheila,” who hits snooze on her alarm clock every morning, starts her day with a huge cup of coffee just to get the caffeine kick, skips the gym because she has no time, gets stuck in rush hour traffic because she hit snooze too many times, missed the first hour of quiet productivity in the morning before other people start coming into the office and constantly interrupting her, and leaves work physically and emotionally tired just to sit in rush hour traffic on the way home and do it all again the next day. There is no reprieve from the relentless daily stress that accumulates day after day.
Sound familiar? It should. In a global study, 30,000 adults were surveyed and results found that stress is the number one issue in workplaces.

“Workplace stress is the new secondhand smoke,” she said. “It has a cumulative impact over time, just like second-hand smoke.”

### FEEL THE BURN(OUT)

So, when you do what Sheila does day in and day out, it has a cumulative negative impact. In fact, Dr. Gray further explained, in just four to eight weeks of continued stress, it can affect your actual DNA. Weight loss (and gain) is affected by stress. And stress leads to burnout.

Burnout means exhaustion, cynicism, and inefficiency. In Sweden, Dr. Gray said, they have ways of predetermining burnout. There is nothing like that in America. In the U.S., burnout costs $125-190 billion in healthcare spending annually—roughly equivalent to New Zealand’s GDP.

“We went from the era of infectious disease to the era of chronic disease, and now we are in the era of mental disease with upwards of $190 billion in healthcare costs related to burnout,” she said.

In a study by Kronos, 63% of registered nurses in the U.S. reported experiencing burnout, affecting patient care as well as patient satisfaction. But overwhelming numbers reporting excessive workloads and excessive fatigue from 12-hour shifts, in our culture we tend to blame the victim—it’s your fault that you’re tired and stressed, and your responsibility to fix it.
Dr. Gray argued that instead, we need to look at how we can design for mental well-being. How does our built environment contribute to, or counteract, our stress? She stated that instead of further hindering our mental well-being, buildings can be designed to enhance it.

**DESIGNING BUILDINGS TO COMBAT BURNOUT**

Delos, a wellness real estate and technology company, pioneered the WELL Building Standard. Launched in 2014, it is the first building certification in the world focused on human health. They have 1,002 registered projects and 190.2 million registered square feet in 36 countries (as of October 2018).

There are seven main concepts in Version 1 of the WELL Building Standard:

- **Air**
- **Water**
- **Nourishment**
- **Light**
- **Fitness**
- **Comfort**
- **mind**

For the mind component, the WELL Building Standard acknowledges that mental health is critical to survival, so what can be done in the built environment to address stress its chronic manifestation, burnout?

They key is to allow people to adapt and give them the power to control their own environment as they need to.
“We’re not going to design a building that is perfect for everyone at all points in the day,” Dr. Gray said, “but we can allow them to have control.”

Giving people control over their environments means have adaptable spaces that they can use at different points during the day as their needs change. It means having dedicated “sleep zones” so when afternoon fatigue sets in, people are encouraged to get some rest and recharge. NASA has found 40-minute naps are connected with improved efficacy in their surgeons and pilots...imagine what they can do for the average office worker.

It means have dedicated quiet areas as well as noisy areas, because most people don’t want complete silence all day, nor do they want the distraction of noise all day. For this, they have “focus zones” as well as “collaboration zones,” because for well-being humans need other people. Control over sounds and noise also means offering options like noise blocking, sound masking (with “pink” noise and “brown” noise), and nature-based soundscaping.

Nature-based design is part of the WELL Building Standard, bringing the joy of nature into the indoors as well as the curiosity of finding it, offering areas of respite, and encouraging rejuvenating movement throughout the day.

In one study, subjects saw either green roofs or concrete roofs during short breaks between cognitive tasks:

- **6%** increase in concentration levels for those who saw green roofs.
- **8%** drop in concentration levels for those who saw concrete roofs.
WELL-BEING MEANS MORE THAN HEALTH

“Sitting is the new smoking,” said Dr. Gray. “Even small movements every hour have a huge effect. Sitting for eight hours or longer decreases life expectancy by 10 years. Physical inactivity is the number four leading cause of death in the world.”

She concluded, “Well-being is not about being ‘not sick.’ We’re living in buildings meant to protect us but we’re not adapting well. We’re not recovering, we don’t have control, we’re not paying attention to our biological cycles, we’re not promoting well-being, we’re not engaged, we’re not stimulated, we’re not encouraged to have relationships. So how do you think we’re adapting, or failing to adapt?”

It’s not enough to have a “healthy building.” LEED Platinum Certified is not enough. It’s not enough to say you have a healthy building; that is something that must be demonstrated over time through performance, and in doing so that will set the standard that allows people to evolve the best.
THE RETREAT FOR THOSE THAT PLAN, DESIGN, BUILD AND OPERATE SPACES WHERE HEALTHCARE IS DELIVERED...

HealthSpaces

November 10–12, 2019
Palm Springs, CA

Learn more or request an invite at:
www.healthspacesevent.com

With Keynote Speaker:
Daniel Kraft
Founder and Chair
Exponential Medicine

and many more TBA!